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DEDICATION
OF THE
WARD MEMORIAL

CHICAGO, 1927

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DEDICATION OF THE MONTGOMERY WARD MEMORIAL BUILDING

ELIZABETH J. WARD

Great benefactor of Northwestern University, notably in the gift of the Montgomery Ward Memorial Building with endowment therefor; trustee of the University at the time of her death. A kindly, friendly woman, a devoted helpmeet of her husband, A. Montgomery Ward.

Dedication

OF THE

Montgomery Ward Memorial Building

NORTHWESTERN UNIVERSITY

MEDICAL SCHOOL

ALEXANDER McKINLOCK

MEMORIAL CAMPUS

CHICAGO

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INTRODUCTION

The Medical School of Northwestern University, established in 1859, assumed from the outset a leading position in American medical education. With the years the School has continued to grow in educational prestige and power and has become known throughout the world as an institution of high ideals, manned by outstanding clinical and laboratory teachers.

Research has had its share of attention and from the laboratories and clinics of Northwestern have emanated many of the forward steps in both medicine and surgery. With the development, however, of an increasing need for men and equipment a program was inaugurated which achieved fruition in the gift of Elizabeth J. Ward. The organization under this gift, the stimulus which it provided, the men who have been gathered to augment a strong existing staff bid fair to greatly increase scholarly productivity with resultant benefit to humanity.

This volume is but a feeble expression of the deep gratitude of the Medical Faculty, the alumni, and the student body for the Memorial and endowment created by Mrs. Ward as well as an expression of a lasting sense of obligation felt by them and by the entire University to Mrs. Ward, to Dr. Archibald Church and his wife, Margaret Finch Church, to Mellie Manlove Rea, to Mr. Edward G. Elcock, to Mrs. Thomas J. Watkins, to Mr. James A. Patten, to Miss Augusta Elizabeth Lehmann, to Dr. Joseph B. DeLee, to Dr. Arthur H. Curtis, to Mrs. Mary C. Halstead, and to many others for the creation of endowment and for important gifts designed to aid the progress of medical science at Northwestern University.

No single forward step in this great accomplishment could have been made except for the leadership, the devotion and the sacrifice of the Board of Trustees of the University. To them and to President Walter Dill Scott the faculty, the alumni, and the student body join in expressions of admiration and felicitations on the accomplishment. Great wisdom has guided their deliberations and through them, Northwestern University, envisioned in a new light, finds inspiration for a deeper and broader scholastic growth.

Irving S. Cutter

May 4, 1929

Part One

INTRODUCTORY

A. MONTGOMERY WARD

In whose memory the beautiful memorial building housing the schools of medicine and dentistry of Northwestern University was erected by his widow, Mrs. Elizabeth J. Ward.

Part One

INTRODUCTORY

A. MONTGOMERY WARD

A. Montgomery Ward was born at Chatham, New Jersey, February 17, 1844; the son of Sylvester A. and Julia L. M. A. (Greene) Ward. In 1772 his great grandfather Israel Ward served as a captain under Washington in the French and Indian War. His great grandfather Zeptha Squire was an officer in the Revolutionary War.

When Montgomery Ward was but a youth his family moved to Michigan. At the age of fourteen he was apprenticed to learn a trade, and afterwards worked in a stave factory for twenty-four cents a day. Later he worked as a laborer in a brickyard for thirty cents a day, and then as a shoemaker in St. Joseph, Michigan. Finally, he became a clerk in a country store, receiving his board and five dollars a week. At the end of three years he had entire charge of the store and was receiving a salary of one hundred dollars per month.

The customers he waited upon in this country store were largely farmers, and he knew and liked them. From them and from his own experiences he became familiar with farm conditions and the farmer's needs, likes and dislikes, pleasures and difficulties. He saw that the farmer wrested a hard living from the soil, and that when he bought goods it was usually with great inconvenience and but little satisfaction. Good markets were not readily accessible and by the time the farmer could make a purchase the price included several profits.

Mr. Ward decided to change all this. He determined to bring the markets to the farmer and sell reliable goods through catalogues; to buy goods direct from the manufacturer, and to deliver them to the customers, thus largely eliminating intermediate profits. Before long Mr. Ward realized that he had undertaken a task too great for one man's hands and brain, so in 1872 he chose his friend, George R. Thorne, of Kalamazoo as his partner.

The first catalogue which they published was an eight-page book with no illustrations. It contained a list of only a few dozen items, but the prices were "right." Customers were treated fairly, and the guarantee of "Satisfaction or Your Money Back" was adhered to faithfully. Year by year the company became more firmly established, until by 1876 the catalogue contained 150 pages, and the total business of the company amounted to $300,000 annually. During the period between 1883 and 1900 Mr. Thorne's five sons were admitted to the firm.

In 1889 Montgomery Ward and Company was incorporated. Early in the history of the company a vehicle factory employing 200 persons was erected in Chicago; an agricultural implement factory employing 200 persons, at Sycamore, Illinois; and a clothing factory in Chicago employing 250 persons.

Montgomery Ward and Company was the first concern to engage extensively in catalogue and mail order business, and it has become the largest mail order house in the United States, if not in the whole world. Its customers now number about eight million, and live in every state in the Union, Canada, South America, and other parts of the world. Merchandise plants are either owned or controlled in Chicago; Kansas City; Portland, Oregon; St. Paul; Baltimore; Oakland, California; and Fort Worth, Texas. Fifty retail chain stores are operated in the larger cities throughout the United States.

Mr. Montgomery Ward was president of the company until his death on December 7, 1913.

Throughout his life, Montgomery Ward was active in various philanthropic and civic movements, notably the conservation of the lake front for "the poor people of Chicago—not the millionaires." His twenty-year fight to keep buildings of all kinds from Grant Park involved litigation which four times carried him to the Supreme Court of Illinois and as often brought him victory. Because of his persistent and successful efforts he was popularly known as "The Watch-Dog of the Lake Front."

In 1909 he said:

> It has been an uphill fight but the victory is sweet. Had I known in 1890 how long it would take me to preserve a park for the people against their will, I doubt if I would have undertaken it. . . . Here is a park frontage on the lake, comparing favorably with the Bay of Naples, which city officials would crowd with buildings, transforming the breathing spot for the poor into a showground of the educated rich. I do not think it right, and the highest court in the State has thrice upheld me. I have nothing at stake in this fight but the good will of the people now and for future generations.

ELIZABETH J. WARD

Elizabeth J. Ward,[1] daughter of Merritt David Cobb and Maria Constantine Cobb, was born in Kalamazoo, Michigan. Her education was obtained at a private school in that city. On February 22, 1872, she married A. Montgomery Ward, a young merchant of Chicago, and was his devoted helpmate throughout his life. Following his death in 1913 Mrs. Ward became deeply interested in educational work and made gifts totalling eight million dollars to Northwestern University for the erection and endowment of the Montgomery Ward Memorial—an institution created for the advancement of medical science. On May 6, 1924, Mrs. Ward was elected as a member of the Board of Trustees of Northwestern University. During the summer of 1926, while en route from California to Chicago with her daughter Marjorie, Mrs. Ward was taken seriously ill. After reaching Chicago, ill and suffering as she was, she insisted that the chauffeur drive her past the Ward Memorial Building, then nearing completion, in order that she might look upon the fruition of her ideal. A few hours only after reaching home she lapsed into unconsciousness and death claimed her early in the morning of July twenty-sixth. The funeral at the home was unusually impressive and was dignified by an appreciation of Mrs. Ward spoken by Walter Dill Scott, President of Northwestern University. President Scott in a few simple words pictured her character: a womanly woman with no personal ambitions, genuine, human, imbued with the highest ideals of service to humanity.

At the time of the death of Elizabeth J. Ward, President Walter Dill Scott issued the following public tribute:

"A University can accomplish its purpose only by the co-operation of many who are interested in the results it attempts to secure. During the seventy-five years of its existence many thousands of persons have made Northwestern University the agency through which their co-operation has been exerted.

"Among all these thousands Governor John Evans was believed to be the greatest friend of Northwestern. With each succeeding year we have come to appreciate more and more the significance of the services he rendered by his wisdom, by his generosity and by his untiring activity in the interest of the projects undertaken by the University.

"Those now intimately in contact with the activities of the University recognize that Mrs. Montgomery Ward has been the greatest of all our friends. This estimate on our part is not based on the fact that she made Northwestern University the agency through which she invested $8,000,000 in public welfare, but it is based on the spirit in which she made her investment, and the purpose she sought to attain thereby. By her investment she sought to accomplish two things:

"First, to create a memorial that for centuries to come would be worthy of her distinguished husband. Second, to make the greatest possible contribution to the advancement of science, to professional training and to the service of the needy in Chicago for all time.

[1]See portrait, frontispiece.

"As we contemplate her achievements we realize that immortality is not restricted to a future world, but that for herself and for her husband she has secured the most worthy form of earthly immortality. It may be necessary from century to century to renew the stone walls of the Montgomery Ward Memorial Building, but the building in some form will probably stand as long as our civilization endures. The problems of research that are attacked by men of science in our Medical and Dental schools may one by one be solved, but further problems will arise as long as the inquiring mind of mankind endures. The present generation of students will receive their training and go forth to serve their respective communities, but new generations will seek professional training as long as youth requires training. The medical and dental clinics will provide service to the needy of the community as long as human ills endure.

"Mrs. Montgomery Ward and her illustrious husband have not ceased to be effective participants in the activities of this community. Their services have not ceased at Rosehill. In the Montgomery Ward Memorial Mrs. Ward has made an investment for all time. December fourteenth has been set aside at Northwestern University as the memorial day for Mr. and Mrs. Montgomery Ward. On that day we shall remind the rising generation of the nobility of purpose, and the effectiveness of the plan which was entered into by Mrs. Montgomery Ward on December 14, 1923.

"All her friends are unspeakably shocked at the announcement of the unexpected death of Mrs. Montgomery Ward. All who had had the privilege of knowing her had come to love her, and hoped that she would have many years in which to enjoy the fruition of the projects which were so dear to her heart.

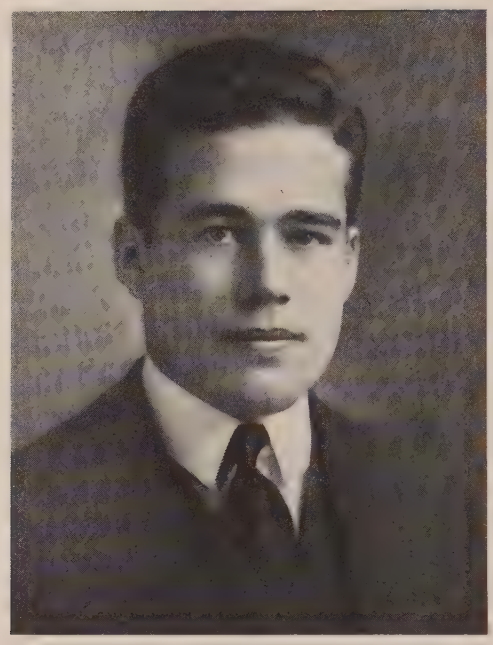
"Those of us who are associated with the University came to know her first through her generosity. Later she became a member of the Board of Trustees of Northwestern University and through her co-operation we learned to know her, and to appreciate her qualities of kindliness and devotion. In all her contacts she endeared herself to us more and more."

CHARLES H. THORNE

Trustee of Northwestern University, adviser and counsellor of Elizabeth J. Ward.

CHARLES HALLETT THORNE

Charles Hallett Thorne was born in Chicago on December 3, 1868, the son of George R. and Ellen (Cobb) Thorne. He was educated at the Hyde Park High School, Chicago, and at the University of Michigan. In 1891 he married Belle Wilber of Peoria, Illinois. Their three children were named Hallett, Elizabeth (Mrs. Robert Andrews), and Leslie. Mr. Thorne entered the employ of Montgomery Ward and Company as a stock clerk in 1889, becoming treasurer in 1893, president in 1914, and later chairman of the board. He has now retired from active business. For many years he has been a director of the Continental and Commercial National Bank of Chicago, a trustee of the Art Institute of Chicago, and a trustee of Northwestern University. He was Commissioner of Public Welfare of the State of Illinois under Governor Lowden during the period from 1917 to 1921. Following the death of Montgomery Ward, Mr. Thorne was adviser to Mrs. Ward and aided her greatly in planning the memorial to her husband—the Ward Memorial Building on the McKinlock Campus of Northwestern University.



ALEXANDER McKINLOCK, JR.

A representative of the finest type of American youth; a hero of the World War, to whose memory the Chicago Campus of Northwestern University is dedicated.

ALEXANDER McKINLOCK, JR.

He showed noble disregard of self and devotion to duty by traversing the front lines for information necessary in connection with his work as intelligence officer, and while fearlessly performing this work was killed.

Thus reads the citation in connection with the award of the Distinguished Service Cross to Alexander McKinlock, Jr., one of the finest of the young men who tossed life and hope like a flower before the feet of their country and their cause; who gave freely and eagerly all that they had or hoped for to their country and to their fellow men in the hour of great need.

George Alexander McKinlock, Jr., was born in Chicago on May sixteenth, 1893, the only child of George Alexander and Marion W. (Rappleyé) McKinlock. In 1905 he entered St. Mark's School, Southborough, Massachusetts, where he was beloved of his school mates, especially because of his prowess in football, hockey, and baseball. In 1912 he entered Harvard, where he achieved especial renown as a member of the football team.

The headmaster of St. Mark's in a letter printed in the *Memoirs of the Harvard Dead in the War against Germany* says:

> Many young men who entered the war were drawn by the love of adventure and the excitement of getting into the fight. McKinlock, however, much preferred peace and the opportunity for other kinds of service, but nothing could keep him from fulfilling his obligation. From the moment his life began in the training camp to the moment he fell, he entered heart and soul into the task before him, using all his energies, physical, mental and spiritual, in full measure pressed down and running over.
>
> McKinlock's friends always speak of his clean-mindedness, but it was more than that. He had a clarity of soul and cared only for the things that were true, pure, honorable, and of good report. He did not wear his heart on his sleeve, but his affections were deep and strong; his responsive smile revealed the mind, heart, and soul.

On graduating from college in 1916, McKinlock entered his father's business, the Central Electric Company at Chicago. Beginning at the bottom, he endeared himself to his fellow-workers, who would some day—as they all thought—become his employees. The laborers in the packing rooms looked up to him because, with his uncommon strength, he could toss a box higher than any of them. Throughout the organization his sense of justice and his consideration for others bespoke a genuinely democratic instinct, the best augury for the future of the business. When he left for the war, the faith and courage with which he went were a strength to those who remained at home.

In May, 1917, he joined the Reserve Officers' Training Camp at Fort Sheridan and received a commission as Second Lieutenant of Cavalry in August of that year. He was immediately selected for service in France and sailed on the *Kroonland* in September. At Gondrecourt and other towns in France he attended training schools and in February, 1918, was appointed as intelligence and liaison officer on the staff of Major Davis, Second Brigade, Third Machine Gun Battalion, First Division. In June, 1918, General Buck chose him as intelligence officer on his staff, and McKinlock's subsequent military record included engagements at Cantigny and in the Marne-Aisne offensive.

Major-General Buck, in September, 1918, wrote to McKinlock's father:

> We had been engaged in a four-days' battle, the culmination of which was the capture of Berzy-le-Sec, just south of Soissons, July 21, 1918. I sent your son, one hour after the capture of the village, to definitely locate our lines in advance of the village. He did not return. I sent another staff officer late that evening to make a diligent search and inquiry about him. Your son was traced to the village. He had been seen going down the Ploisy ravine accompanied by two French officers. All three entered the village together. As they were passing through the eastern edge of the village there came a burst of machine gun fire from long range. . . . In sending him to make a sketch of the position of our troops I had no idea he was to be in any danger, as I and another staff officer had come from the immediate vicinity only an hour or two previously. Please accept my sincere condolence and share the hope that he may be a prisoner and may safely return to you some day.

McKinlock was at first reported missing and it was some time before a fruitless search of the hospitals and the testimony of witnesses identified him as one of the American officers who had been seen to fall on July 21, 1918. It was finally determined that one hour after Berzy-le-Sec had been taken, McKinlock was sent forward to verify the position of the front lines. According to the testimony of a chaplain, McKinlock met French officers on a similar mission and when walking with them in the

town of Berzy was killed by a Boche sniper. Several circumstances combined to throw uncertainty on this account, but it was finally verified. After a long search, the boy's mother found his grave in a small garden in Berzy. The cross marking the grave bore the inscription: "To the American soldier who had died gloriously for liberty."

On December 29, 1918, Colonel Davis wrote to McKinlock's father as follows:

> George joined my battalion in January, 1918. I at once noted his fine qualities and detailed him for duty on my staff. We were very closely associated for many months, during which time I learned much about his past life. I have never known a man who so thoroughly loved his home and his parents. Many nights we rode our horses well out into the various sectors and never will I forget our conversations or rather his as I was quite content to ride silently and listen to this exceedingly clean and noble-minded young man, who loved his mother as a sweetheart and longed for the day when he would go into business with "dad," as he called you, and pal with his mother as he had before. It was an inspiration to me, and I became tremendously fond of him. His loss was a cruel blow—such men are an asset to the army and to the nation.

Young McKinlock had been recommended for a captaincy but was killed before the recommendation could be acted upon. For his special gallantry he was awarded the Croix de Guerre with Palms, the Distinguished Service Cross and a recommendation for the latter a second time. The citation for the posthumous award of the Distinguished Service Cross read as follows:

> For exceptional gallantry under heavy artillery bombardment and severe machine gun fire in proceeding along the front lines near Berzy-le-Sec to verify the position reports of the advanced locations of the front lines, and was killed while so doing.

Northwestern University

EVANSTON CHICAGO

WALTER DILL SCOTT, *President of the University*

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JOSEPH B. DELEE
JAMES G. CARR
GEORGE W. WEBSTER

*Deceased.

WALTER DILL SCOTT

President of Northwestern University since 1920, under whose inspiring leadership the physical equipment of the University has more than doubled, the already strong faculty has been greatly strengthened, and distinct educational advancement has been achieved.

WILLIAM A. DYCHE

Trustee of Northwestern University since 1894; Business Manager for more than twenty-five years. Wise counseller, able financier, and far-sighted executive, to whom Northwestern University owes in large measure its present position in the educational world.

ROBERT W. CAMPBELL

President of the Board of Trustees of Northwestern University since 1916, under whose leadership and through whose wisdom, foresight, and courage the trustees have been able to bring to fruition outstanding accomplishments.

IRVING S. CUTTER

Dean of Northwestern University Medical School since 1925.

CHARLES P. WHITNEY

Chairman of the McKinlock Campus Building Committee, who gave unstintingly of his time, and devoted his outstanding business acumen to the multitudinous details of the planning and construction of the buildings on the McKinlock Campus.

THE McKINLOCK CAMPUS COMMITTEE

Charles P. Whitney, *Chairman*	George W. Dixon
Herbert S. Philbrick, *Secretary*	George A. McKinlock
Walter Dill Scott, *Ex Officio*	George P. Merrick
William A. Dyche, *Ex Officio*	Edwin S. Mills
Robert W. Campbell, *Ex Officio*	James F. Oates
Frank S. Cunningham	Philip R. Shumway

This Committee had entire charge of the building operations in connection with the erection of the Montgomery Ward Memorial Building, the Wieboldt Hall of Commerce, the Levy Mayer Hall of Law, and the Gary Library of Law.

Part Two

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL

EARLY HISTORY

The first entry in the record book of the faculty of Lind University reads as follows: "At a meeting held March 12, 1859, at the office of Drs. Rutter and Isham, the following named gentlemen were present: David Rutter, M.D., Hosmer A. Johnson, M.D., Edmund Andrews, M.D., and Ralph N. Isham, M.D. It was announced in a few words by Dr. Johnson that the object of the meeting was to organize a Medical

Lind Block, on the corner of Randolph and Market Streets. The Medical Department of Lind University occupied rooms on the third and fourth floors of this building from 1859 to 1863.

Faculty of the Lind University on the basis of a proposition made by the Trustees of Lind University, and submitted to the above-named gentlemen for their consideration."

As a result of this meeting in 1859, the Medical Department of Lind University was organized—the first medical school to establish a graded curriculum as requisite for the degree of doctor of medicine.

The faculty as organized and approved by the board of trustees of Lind University was constituted as follows:

THE CHICAGO MEDICAL COLLEGE, *Prairie Avenue and Twenty-Sixth Street, 1870–1892.*

David Rutter, M.D., Emeritus Professor of Obstetrics.
Hosmer A. Johnson, M.D., Professor of Materia Medica and Therapeutics.
Edmund Andrews, M.D., Professor of Principles and Practice of Surgery.
Ralph N. Isham, M.D., Professor of Surgical Anatomy.
Nathan S. Davis, M.D., Professor of Principles and Practice of Medicine.
William H. Byford, M.D., Professor of Obstetrics and Diseases of Women.
John H. Hollister, M.D., Professor of Physiology and Histology.
F. Mahla, M.D., Professor of Chemistry and Toxicology.
M. R. Taylor, M.D., Professor of General Pathology.
Titus Deville, M.D., Professor of Descriptive Anatomy.
Henry G. Spofford, Esq., Professor of Medical Jurisprudence.
Horace Wardner, M.D., Demonstrator of Anatomy.

The Medical Department of Lind University was originally housed on the third and fourth floors of the Lind Block (see figure on page 15) at the corner of Randolph and Market streets (one of the few downtown buildings to escape the Chicago fire). Facilities for clinical instruction were furnished by Mercy Hospital, an orphan asylum adjoining the hospital, and a free dispensary in one of the rooms of the Medical School.

At the formal opening of the first college term on October 9, 1859, Dr. Hosmer A. Johnson, Dean of the School, presided and Dr. N. S. Davis gave the introductory address. On the following morning the first didactic lecture was given by Dr. John H. Hollister.

For four years the faculty of the Medical School efficiently sustained its organization for better preliminary education, longer annual college terms, a properly graded curriculum, and direct clinical instruction. The number of students increased from thirty-three in the first year to seventy-nine in the fourth year.

By 1863 the disturbing influences of the Civil War and the financial failure of Sylvester Lind, who had promised an endowment of $100,000, necessitated the re-

THE CLASS OF 1881 *grouped on the steps of the Calumet Avenue entrance to Mercy Hospital. Dr. N. S. Davis, in high silk hat, is standing in the center of the balcony.*

organization of Lind University (later Lake Forest University). As a result the Medical faculty was thrown entirely on its own resources, and the Chicago Medical College was thereupon founded with Dr. Hosmer A. Johnson as President, Dr. Edmund Andrews as Secretary of the Board of Trustees, and Professor N. S. Davis as Dean of the Faculty. A lot was purchased on State near Twenty-Second Street, and a building erected in time for the opening of the college term in October, 1863.

In 1869 the Chicago Medical College became affiliated with Northwestern University and in 1870 moved to the new building (see figure on page 16) erected on the

DAVIS HALL

NORTHWESTERN UNIVERSITY MEDICAL SCHOOL, *Dearborn and Twenty-Fifth streets, 1893–1926. Davis Hall is at the right.*

corner of Prairie Avenue and Twenty-Sixth Street, adjoining Mercy Hospital. On the occasion of the dedication of this new building, Dr. Hosmer A. Johnson, Professor of Diseases of the Circulatory and Respiratory Organs, gave an address entitled *History of the Chicago Medical College—an Introductory Lecture to the College Session of 1870-71.* The following quotations are taken from Dr. Johnson's address:

"The College continued to occupy the rooms in Lind's Block, on Market Street, during the session of 1862–3, paying to the proprietors the rent out of the College funds. In the summer of 1863, the Faculty by a unanimous vote resolved to appropriate the proceeds of their lectures to a building fund, for the purpose of securing new accommodations for the institution." A contract was made with C. Follansbee, Esq., for a lot and building on State at Twenty-Second Street. "By the liberality of one of its members, the Faculty was subsequently entirely relieved from the indebtedness thus contracted." In 1869 "an arrangement, mutually satisfactory, was made with Northwestern University by which the Chicago Medical College became the Medical Department of that institution, its own organization, control of professorships and of the curriculum of study remaining unchanged. The ground occupied by the present building, belonging to the proprietors of the Mercy Hospital, had been previously secured for the use of the College. By the terms of the contract between the Trustees and Hospital authorities, the Faculty of this Institution became the medical officers of the Hospital, and are required to give in its wards such clinical instruction as the interests of the College demand; the services of these medical officers to be considered as payment in full for the ground-rent of these premises, for at least twenty years, and so much longer as the adjacent building shall be occupied for hospital purposes. It is believed that the interests of both parties to this contract are met in the permanent relations thus established. The material result of these arrangements with the University and the Society owning and controlling the Hospital is the elegant and convenient building in which we are tonight, for the first time, assembled. It is not only architecturally attractive and admirably adapted to medical teaching, but its location and relations to the Hospital are such that for all practical purposes that institution becomes a part of the college organization."

By 1890 Mercy Hospital needed the ground on which the college building stood and the college needed new buildings to accommodate its laboratories and growing dispensary. With the aid of William Deering, a staunch friend of Northwestern University, land was purchased on South Dearborn Street between Twenty-Fourth and Twenty-Fifth streets, adjoining Wesley Hospital, and buildings were erected and occupied in 1893. At this time a closer union with the University was effected and the Chicago Medical College, the Medical Department of Northwestern University, was thereafter known as Northwestern University Medical School. The buildings on Dearborn Street were occupied continuously from 1893 until the completion of the Ward Memorial Building on Chicago Avenue and the Lake in the autumn of 1926.

THE McKINLOCK MEMORIAL CAMPUS

As far back as 1913, plans were being discussed for the consolidation of all of the professional schools of Northwestern University on a single "downtown campus" on the near north side.

In 1915 a preliminary draft of a plan for a downtown campus was drawn up by the Committee on Endowment of Northwestern University in which the purchase of the Farwell and Fairbank tracts at Lake Shore Drive and Chicago Avenue was strongly advised as it was feared that the opportunity to secure the only available site on the north side would be lost. In 1917, Mr. William A. Dyche, Mr. Philip R. Shumway, and General Nathan William MacChesney, constituting a committee of three, secured an option on the site without cost to the University from Mr. Kellogg Fairbank and Messrs. John V. and Arthur L. Farwell.

Time drifted along. Mr. Dyche was doing valiant service persuading the trustees that the tract should be purchased, and interesting particularly Mr. Milton H. Wilson, without whose generosity and vision the entire project never could have been consummated. Meanwhile the War had broken out and plans were still further delayed.

Finally, on June 15, 1920, during the presidency of Dr. Lynn Harold Hough, the Board of Trustees voted to make the purchase of the nine acre tract for $1,420,260.

Thus was taken one of the greatest forward steps in the history of the University since its establishment in 1851. Without the generosity of Mr. Wilson and the vision, courage and persistency of Mr. Dyche and others the project would not have achieved fruition.

The Memorial to Alexander McKinlock, Jr.

At the close of the ceremony of inauguration of Walter Dill Scott as president of Northwestern University, held in the Patten Gymnasium, Evanston, on June 14, 1921, announcement was made of the receipt of a gift of $250,000 to the University from Mr. and Mrs. George A. McKinlock in memory of their son, George Alexander McKinlock, Jr., who was killed on July 21, 1918, at Berzy-le-Sec, France.

By order of the Board of Trustees of the University the new Chicago campus was named the Alexander McKinlock, Jr., Memorial Campus in honor of Alexander McKinlock, Jr., and his comrades who were killed in the World War.

When President Scott announced the receipt of this memorial gift he said, "Our dream has been that these nine acres at Chicago Avenue and Lake Shore Drive might be used as an appropriate memorial to the student soldiers of America, but until today it was merely a dream."

The Gift from Elizabeth J. Ward

In December, 1923, Mrs. Elizabeth J. Ward gave the University the sum of one million dollars, augmented by the sum of three million dollars on January, 1924, to be used for the erection of a building as a memorial to her husband, A. Montgomery Ward. This building was to house the laboratories and necessary clinics of the School of Medicine and the School of Dentistry. In March, 1926, Mrs. Ward added another

four million dollars to her original gift, the income of which is to be used for research, scholarships, and increased instructional facilities.

In making this gift Mrs. Ward stressed *service* as follows:

It is my desire to create a worthy and appropriate memorial to my late husband, A. Montgomery Ward. His most conspicuous public service was in his long-continued effort to conserve the Lake Front for the use of the people.

It seems to me that a memorial should contain the following elements: It must be a visible thing which adds something to the values of the city; it must be enduring; it must be useful to humanity.

It has been called to my attention that Northwestern University has recently acquired a site for an urban campus on the Lake Shore at Chicago Avenue, designed to accommodate a Medical Center, a School of Commerce, a School of Law, and other departments, all housed in suitable buildings. This campus offers opportunities particularly appropriate for the memorial which I have had in mind.

The proposed style of architecture is fitting for an institution of higher learning and sufficiently impressive to stand out even among all the buildings located on the Lake Shore Drive and overlooking the Lake. By its location, by its architecture, and by its activities to be performed thereon, this campus will add an element valuable to the city and necessary to its proper development.

It is my belief that Chicago, situated as it is in the center of the district richest in agricultural and natural resources in the United States, protected by the pendulum of Lake Michigan, is destined to become a very great city including in its greatness permanent centers for all forms of philanthropic and educational work. Northwestern University, the first university founded within the city of Chicago, has been steadily developing, but with its plans for future growth will more fully realize its opportunities and continue to develop as the city develops.

Endowed universities seem to me to be the most enduring of all human institutions, and Northwestern University, by its location and by its history, seems destined to endure.

I am led to believe that the ideal of *service* dominates the various schools of Northwestern University. It has been reported to me that during the last year your Medical School through its dispensary and out-patient service and your Dental School through its clinics have helped thousands of patients. This service evidences a wide and important charity which with increased facilities will become more and more useful to humanity.

I have selected as a memorial the Medical Center, because of its commanding site overlooking the Lake, because it will render a very large measure of service to humanity, and because it will be as enduring a memorial as can be devised.

The plan taken as a whole seems to me to make adequate provision for centers of Medicine, Law, and Commerce, with ideals of quality rather than quantity.

It is my belief and hope that with the completion of the three principal units, others will see opportunity to assist in rounding out the project.

Therefore, it gives me great pleasure to present to Northwestern University a Deed of Gift for three million dollars for the erection and endowment of a Medical Center for Northwestern University as a Memorial to Montgomery Ward, to be located upon the McKinlock Memorial Campus.

The new Medical Center of Northwestern University shall conduct approximately the following activities:

Individual—To impart available medical and related knowledge to students, internes, postgraduates, nurses, and social service workers.

Humanitarian—To advance the frontiers of medical and related knowledge through research; to acquire knowledge of the natural history of disease, leading to the prevention of disease; to improve existing methods of treating disease.

Civic—To render community health service by promoting periodic medical examination; also by efforts to readjust the occupational and social life of those in the incipient stages of disease and by the treatment of disease.

GREATER NORTHWESTERN UNIVERSITY CAMPAIGN COMMITTEE—1924

Fig. 1. From left to right: President Scott, Dr. Archibald Church, Miss Marjorie Ward, Dr. George W. Webster, Mrs. Elizabeth J. Ward.

Fig. 2. Charles H. Thorne, Miss Marjorie Ward, Dr. George W. Webster, Mrs. Elizabeth J. Ward, Dr. Thomas L. Gilmer.

THE GROUND-BREAKING CEREMONIES

Alexander McKinlock Memorial Campus

> Silver spades gleaming in the sunlight against the new black earth, purple robes and mortar boards of collegiate rank invading the downtown district, youth trailing at the heels of a group of elderly millionaires planting the seeds of a future civilization and on the wings of song the chant of *Quaecumque Sunt Vera.*[1]

The ground breaking for five great buildings and the inauguration of a new campus for Northwestern University took place on May 8, 1925, a day planned primarily in honor of the eight donors who had made possible the building of the first unit of the $25,000,000 educational enterprise in the heart of Chicago. The exercises were extensive in character and included the ground-breaking ceremonies for the Montgomery Ward Memorial, the Wieboldt Hall of Commerce, the Levy Mayer Hall of Law, the Gary Library of Law, the Thorne Auditorium, and the dedication of the McKinlock Memorial Campus. This particular May day had been chosen because it was the seventy-fifth anniversary of the founding of Northwestern by a small group of Chicago men.

[1]The Chicago Tribune, May 8, 1925.

In preparation for the ground-breaking ceremonies, the exact site each building was to occupy had been clearly marked and appropriate banners and flags displayed. At the east end of the campus near the lake a large platform had been erected to accommodate all who were to participate in the ceremonies.

Here were gathered the officials of the University, the donors, prominent alumni of the University, Mayor Bartlett of Evanston, Mayor Dever, and other officials of the city of Chicago, giving formal recognition to this splendid addition to the "city beautiful." Half a hundred leaders in affairs participated in the ceremonies led by President Scott and General MacChesney, Chairman of the Day.

The following order of exercises was observed: *The Star Spangled Banner* was played by the University Band; the Reverend George Craig Stewart pronounced the invocation, followed by the chanting of the University Hymn, *Quaecumque Sunt Vera* by the A Cappella Choir. Mr. Robert W. Campbell, President of the Board of Trustees, brought official greetings.

President Walter Dill Scott briefly reviewed the history of Northwestern University:

MR. AND MRS. GEORGE A. MCKINLOCK (*center foreground*) *at the dedication of the Alexander McKinlock Memorial Campus, May 8, 1925.*

ADDRESS BY PRESIDENT SCOTT

In May, 1850, nine young men assembled in a law office less than one mile from this spot. They were typical of the better class of young men of the city's population of 29,000. They had come to Chicago from the East and were hopeful of the future of the city. Each man was under forty years of age, and each expected to win a fortune, but it was not his intention to exploit his fellow-citizens and to advance himself by injuring or even by disregarding the interests of others.

The outstanding members of the group were Governor Evans, Orrington Lunt, and Judge Goodrich. These three and their associates were inspired to an unusual degree with the spirit of service. They met on that May day, not to consult as to methods of advancing their own fortunes, but as to methods of promoting the welfare of their fellows.

After long deliberation they decided that the most effective way of serving their fellow-citizens would be through the founding of an institution of higher learning. They did not regard a university as an object of charity, but as an agency through which they could co-operate with the charitable organizations, and could in the most effective way possible promote all the social service agencies of the community. The University was not, therefore, an institution to which they could give money, but one in which they could invest funds in the interest of public welfare. They not only invested their funds in the University, but they invested their time and their thought. By their devotion to the institution they enabled it to render the service for which it was founded, and from that May day of 1850 to this May day of 1925, Northwestern University as an institution of higher learning has been an effective social service agency in Chicago and the great Northwest Territory.

In those seventy-five years some thirty thousand citizens of Chicago have availed themselves of Northwestern as an agency through which they have invested funds in the promotion of the public weal. More public-spirited citizens have turned to Northwestern during the last three years than ever before in the history of the University. This is in part due to the fact that the proposed Alexander McKinlock Memorial Campus offered a greater opportunity for service to the citizens of Chicago than had previously been available. In that group are six persons whom we have met today to honor, while we break ground for a campus and for the buildings which their generosity has made possible.

Mrs. Montgomery Ward is building the most noble memorial ever built by any citizen of Chicago. The Montgomery Ward Memorial will give earthly immortality to one who by his wisdom, by his integrity, and by his devotion to the principle of service, created a new form of business. In investing in this Memorial Mrs. Montgomery Ward displayed sagacity as great as did her far-seeing husband in creating that new form of business. This Memorial shall always be a center of service at which hundreds of thousands shall find relief from those ills which are a part of the burden of suffering humanity, and where permanent cures shall be found for diseases still unconquered by medical skill.

Mrs. Levy Mayer in her benefaction is carrying out a plan which had already been formed by her devoted husband. She is creating a worthy memorial to one who stood pre-eminent at the Chicago bar, and she is providing the building in which for centuries to come shall be trained many select youths of America who aspire to eminence in the profession which he honored by his distinguished career.

Mr. and Mrs. William A. Wieboldt have done more than any other citizens of Chicago in promoting the interests of the social service organizations of this city. In creating Wieboldt Hall they have given expression to the fact that the most effective form of charity is developing self-supporting men and women. They have by this and by their unnumbered generous deeds given us an example of unselfish accomplishment that will inspire every student that enters Wieboldt Hall.

Judge Elbert H. Gary is still claimed as a citizen of Chicago, however, on temporary leave of absence in the city of New York. He is an alumnus of Northwestern University. Here he became eminent in the legal profession and in the administration of business. Here was begun his interest in the science of justice, and here he began the creation of a great law library. As a benefactor he now remembers the place of his nativity, he honors his Alma Mater, he builds a library building that will ever continue his life work of causing justice to prevail in all human transactions.

THE MONTGOMERY WARD MEMORIAL BUILDING IN THE PROCESS OF CONSTRUCTION.

1

2

3

4

5

Fig. 1. William A. Dyche watching the first shovel full of earth being removed in the excavation of the foundations of the Ward Memorial Building. Figs. 2, 3, 4, 5, show various stages in the construction of the building.

Mrs. George R. Thorne, as a devoted wife, mother, and sister, has in her benefaction symbolized that which is characteristic of herself and of him whose memory is thus honored. The Thorne Auditorium is in its service not limited to any school or any science, but will serve the interest of all those who are engaged in the promotion of citizenship and in all noble forms of learning. Within its portals will be welcomed gatherings of scholars from all lands which have for their purpose the support of good government or the preservation and the advancement of knowledge.

Mr. and Mrs. George A. McKinlock gave to the city of Chicago and to our nation the greatest gift that can be made by parents. They gave to Chicago a young man of high ideals and unselfish devotion to the task of making Chicago a great and worthy city. They gave to the nation a brave soldier, and he made the supreme sacrifice in the defense of the nation. They gave to this campus a name which shall be preserved in ever-increasing honor.

THE GROUND BREAKING

Following the address of President Scott an academic procession was formed and a parade of the grounds was made under the direction of Colonel R. H. Mills, U. S. A. A beautiful ritual composed especially for the occasion by the Reverend George Craig Stewart was employed in the dedicatory and ground-breaking ceremonies. As soon as the silver spades of the donors had turned the sod, three monster steam shovels began the excavation.

The order of procedure in the ground-breaking ceremonies was as follows:

1. Dedication of the Alexander McKinlock Memorial Campus. Mr. George A. McKinlock, President Scott, Mayor William A. Dever, Mr. Melvin M. Hawley officiating.

2. Breaking Ground for the Elbert H. Gary Library of Law. Judge Elbert H. Gary, President Scott, Mr. Frederic B. Crossley, Judge Charles M. Thomson, Mr. John Smalley officiating.

3. Breaking Ground for the Levy Mayer Hall of the School of Law. Mrs. Levy Mayer, President Scott, Mr. Robert W. Millar, Mr. Homer H. Cooper, Mr. Lothrop F. Follett officiating.

4. Breaking Ground for the Wieboldt Hall of the School of Commerce. Mr. William A. Wieboldt, President Scott, Mr. Walter E. Lagerquist, Mr. George P. Ellis, Mr. Burt C. Brumm officiating.

5. Breaking Ground for the Montgomery Ward Memorial Building (for the Medical School). Mrs. Elizabeth J. Ward, President Scott, Dr. Archibald Church, Dr. George W. Webster, Mr. Herbert John Rinkel officiating.

6. Breaking Ground for the Montgomery Ward Memorial Building (for the Dental School). Mrs. Montgomery Ward, President Scott, Dr. Thomas Lewis Gilmer, Dr. Eugene Maginnis, Mr. Ralph Bengston officiating.

7. Breaking Ground for the George R. Thorne Hall. Mrs. George R. Thorne, President Scott, Dean Raymond Kent officiating.

At the close of the ground-breaking exercises, the Reverend J. Hastie Odgers pronounced the benediction; and the Northwestern Band played *Go U. Northwestern.*

THE CORNERSTONE LAYING

On June 11, 1926, five hundred faculty members, trustees, alumni, students, and friends of the University attended the luncheon at the Furniture Mart, arranged by the Northwestern University Club of Chicago.

The original plan had been to hold all of the ceremonial exercises on the McKinlock Campus, but because of the rain it was decided at the last moment to have the principal addresses given indoors.

After several selections by the University Band and the A Cappella Choir, General Nathan William MacChesney, Chairman of the Day, introduced one of Northwestern's most distinguished alumni, Dr. Charles H. Mayo, who spoke on the subject of *Problems in Medical Education.*[1] Another distinguished alumnus, Dr. George Craig Stewart, Rector of St. Luke's Episcopal Church in Evanston, then gave an address on the *Contributions of the University to Civic and Cultural Life.*

Following the addresses the assembly adjourned to the campus. The rain had ceased, so the impressive and colorful academic parade, under the direction of Major H. M. Tarpley, D.C., U.S.A., led the way to the new buildings under construction, and there the cornerstone of each building was laid with beautiful ceremony following a ritual composed by Dr. George Craig Stewart.

For each cornerstone a metal strong-box had been prepared in which was deposited a brief biography of the donor of the building, a copy of the program and of the addresses of the day, a copy of the Alumni News containing a history of the acquisition and development of the McKinlock Campus, the *Story of Northwestern University,* and lists containing the names of all of the professors who had at any time served on the faculty, of all alumni, and of the present students of the University. All of these documents had been chemically treated so as to be as durable as the buildings themselves.

The order of procedure in the cornerstone-laying ceremonies was as follows:

1. The Elbert H. Gary Law Library Building: Elbert H. Gary (represented by Mrs. Bertha Gary Campbell); Robert W. Campbell; President Scott; Melvin Hawley, President of the General Alumni Association; Frederic B. Crossley, Librarian of the Elbert H. Gary Library of Law.

2. The Levy Mayer Hall of Law: Mrs. Levy Mayer (represented by Isaac H. Mayer); Robert W. Campbell; President Scott; Melvin Hawley; John H. Wigmore, Dean of the School of Law; Homer H. Cooper, President of the Alumni Association of the School of Law; Thomas Vennum, President of the Senior Class of the School of Law.

3. The Wieboldt Hall of Commerce: William A. Wieboldt; Robert W. Campbell; President Scott; Melvin Hawley; Ralph E. Heilman, Dean of the School of Commerce; Leslie M. Gooder, for the Alumni of the School of Commerce; Sidney Braverman, President of the Senior Class of the School of Commerce.

4. The Montgomery Ward Memorial Building: Mrs. Elizabeth J. Ward (represented by Charles H. Thorne); Robert W. Campbell; President Scott; Melvin Haw-

[1]See page 91.

ley; Irving S. Cutter, Dean of the Medical School; Dr. Joseph B. DeLee, President of the Alumni Association of the Medical School; Edward O. Gertenbach, President of the Senior Class of the Medical School; Arthur D. Black, Dean of the Dental School; Dr. Charles R. Baker, for the Alumni of the Dental School; G. R. Timmerwilke, President of the Senior Class of the Dental School.

COMPLETION OF THE MONTGOMERY WARD MEMORIAL BUILDING

By the autumn of 1926 the Medical School had moved from the dingy quarters in the old building on the corner of Dearborn and Twenty-Fourth streets into the spacious, perfectly appointed Montgomery Ward Memorial Building on the McKinlock Campus.

The Medical School now occupies the first seven floors, the fourteenth floor and the first floor of the tower in the Ward Memorial Building. In addition there are shops, library stacks, and storage rooms located in the basement. Approximately one-third of the first floor and all of the second and third floors are devoted to outpatient clinics with adjunct quiz rooms, laboratories, technicians' quarters and the like.

The construction of the building is concrete on a steel framework. The exterior is of grey Bedford stone, exquisitely carved at the doorways, above the central windows, and in the pinnacles of the tower.

Photo by the Chicago Aerial Survey

AERIAL VIEW OF THE MCKINLOCK CAMPUS, 1928, *looking northeast toward Lake Michigan. Passavant Hospital, under construction, is seen at the lower right corner. The Montgomery Ward Memorial Building looms up at the left. Beyond it is Wieboldt Hall with its beautiful smokestack. The roof of Levy Mayer Hall can be seen, as well as part of the Elbert Gary Library and the charming garden at the rear.*

The Alexander McKinlock Memorial Campus, 1928, *showing the Gary Library of Law, the Levy Mayer Hall of Law, the Wieboldt Hall of Commerce, and the Montgomery Ward Memorial Building.*

DEDICATION OF THE MONTGOMERY WARD MEMORIAL BUILDING

School of Medicine

The dedication of the Montgomery Ward Memorial Building took place on June fifteenth, sixteenth and seventeenth, 1927, in conjunction with the dedication of other buildings on the new McKinlock Memorial Campus.

On several occasions during the three-day program, regretful mention was made of the fact that Mrs. Ward had not been spared to share in the celebration and to occupy the chief place of honor which would have been accorded to her.

The Archibald Church Library

The formal dedication of the Archibald Church Library was held on the afternoon of June fifteenth. In the spacious main room of the Library, the trustees, faculty members, alumni, and friends of the University assembled for the ceremony. Dr. Irving S. Cutter, Dean of the Medical School, gave the address of dedication, and Mr. William A. Dyche, Business Manager of the University, unveiled the bronze bas-relief of Dr. Archibald Church, erected in the Library by order of the Board of Trustees of the University. (See pages 34 and 38.)

Unveiling of Portraits. Portraits of the following founders, trustees and distinguished faculty members of Northwestern University Medical School were unveiled: Nathan Smith Davis, David Rutter, William Heath Byford, John Hamilcar Hollister, Robert Laughlin Rea, Ralph N. Isham, Emilius Clark Dudley, Frank Billings, Franklin H. Martin, John Harper Long, and Otto Leopold Schmidt.

The portraits of the following physicians and surgeons were added to the collection subsequent to the formal dedication of the Library: Edmund Andrews, Nicholas Senn, John Ridlon, Edmund Janes Doering, Frank Seward Johnson, Nathan Smith Davis, II, Thomas James Watkins, Charles Horace Mayo and William James Mayo, and Isaac Arthur Abt, as well as a bust of Hosmer Allen Johnson. (See pages 38-78.)

ALUMNI DINNER

About four hundred alumni, members of the faculty, trustees and friends attended the Alumni Dinner held at the Drake Hotel on June fifteenth. Dr. Charles A. Elliott, President of the Alumni Association, presided as toastmaster.

Addresses were given by Dr. S. Walter Ranson of the Washington University Medical School, St. Louis; Dr. Leonard Rowntree of the Mayo Clinic; Dr. Irving S. Cutter, Dean of the Medical School; Mr. Robert W. Campbell, President of the Board of Trustees; and President Walter Dill Scott. (See pages 98 and 104.)

Prominent among the guests were the following alumni and faculty members: Drs. Frank Billings, Charles Mayo, Isaac A. Abt, Joseph B. DeLee, Robert B. Preble, Franklin H. Martin, Samuel C. Plummer, and Archibald Church.

THE FREDERICK ROBERT ZEIT MUSEUM

On June sixteenth, the Frederick Robert Zeit Museum of Pathology was formally dedicated, the chief address being given by Dr. James P. Simonds. (See page 79.)

THE JAMES A. PATTEN RESEARCH LABORATORIES

Dr. Alexander A. Day gave the principal address at the dedication of the James A. Patten Research Laboratories of Bacteriology, which were endowed by Mr. James A. Patten in 1910. (See page 83.)

INSTALLATION CEREMONIES

Dr. Andrew C. Ivy was installed as the Nathan Smith Davis Professor of Physiology on June sixteenth. Dr. Cutter presented a brief history of the professorship, and Dr. A. B. Luckhardt, Professor of Physiology, University of Chicago, recited Dr. Ivy's contributions to the field of Physiology. (See page 87.)

Dr. Leslie B. Arey was installed as the Robert Laughlin Rea Professor of Anatomy. This professorship was endowed by Mrs. Mellie Manlove Rea in memory of her husband, an outstanding anatomist and the first Professor of Anatomy at Northwestern University. Dr. Arey was seated in the chair which was presented to Dr. Rea by his students a half century ago. Dr. Basil C. H. Harvey, Professor of Anatomy and Dean of the Medical Students, University of Chicago, gave a short address. (See page 89.)

The Montgomery Ward Memorial Building.

President Walter Dill Scott conducted the installation ceremony, and Mrs. Rea invested Dr. Arey with the gown and hood of his professorship.

Dedication Convocation

As a fitting climax to a day in which a museum and laboratories had been dedicated, professors installed, and scientific papers presented, the Dedication Convocation was held in the John B. Murphy Memorial Auditorium.

Following the stately procession of the faculty members in caps and gowns, Dr. Archibald Church, presiding officer, formally opened the meeting. The invocation was pronounced by the chaplain of the day, the Reverend John Thompson, pastor of the First Methodist Church of Chicago.

Dr. Hugh Talbot Patrick was then introduced and delivered the address of dedication, entitled *Then and Now* (see page 106).

General Dedication Exercises

The entire group of buildings on the McKinlock Memorial Campus was dedicated on Friday, June seventeenth. The creation of this new center of higher education in business and the professions was solemnized by a ceremony befitting an occasion so significant not only to Northwestern University, but to the city of Chicago and the entire educational world.

Throughout the day various dedicatory exercises were conducted in the new buildings. At noon, more than five hundred alumni, students, trustees, faculty members, and friends attended the luncheon held in the club rooms of the Furniture Mart.

General Nathan William MacChesney presided at the luncheon. President Scott, the several deans of the University, the candidates for honorary degrees, and their presentors, each spoke briefly. The chief guest of the day, the Honorable Frank O. Lowden, was introduced and spoke briefly.

The President's Dinner, following the afternoon dedicatory exercises, was a brilliant affair held at the Drake Hotel. Later, the academic procession from the McKinlock Campus moved sedately to the Fourth Presbyterian Church, where the special convocation services were held.

General Convocation Ceremony

President Scott presided at the convocation ceremony. The Honorable Frank O. Lowden, former Governor of the State of Illinois, gave the address of the evening, entitled *The Rôle of the Social Sciences in Advancing Civilization.*

Honorary Degrees. At the Convocation Service, honorary degrees were conferred as follows: Doctor of Science: Archibald Church, presented by Dean Irving Samuel Cutter. Doctor of Laws: Frederic Robert DeYoung, presented by Professor Robert Wyness Millar. Doctor of Laws: Homer Bliss Dibell, presented by Professor Andrew A. Bruce. Doctor of Laws: Edwin Francis Gay, presented by Dean Ralph E. Heilman. Doctor of Laws: William Searle Holdsworth, presented by Dean John Henry Wigmore. Doctor of Science: William Henry Trueman, presented by Professor William Bebb. Doctor of Science: Roscoe Henry Volland, presented by Professor Robert Edwin Blackwell. Doctor of Laws: Willard Eugene Hotchkiss, presented by Professor Frederick Shipp Deibler. Doctor of Science: Franklin Henry Martin, presented by Professor Allen B. Kanavel. Doctor of Science: Hugh Talbot Patrick, presented by Professor Charles A. Elliott. Doctor of Science: James Harrison Prothero, presented by Professor Edward Howard Hatton. Doctor of Laws: James Gamble Rogers, presented by Professor Herbert Shaw Philbrick. Doctor of Science: John Nicholas Sandblom, presented by Dean Arthur Davenport Black. Doctor of Laws: Arch Wilkinson Shaw, presented by Professor Fred Emerson Clark. Doctor of Laws: Edgar Bronson Tolman, presented by Professor Frederic Beers Crossley.

Scientific Presentations

Throughout the entire dedication week various alumni clinics were conducted in all of the departments of the Medical School. Scientific papers were read by Drs. Leonard G. Rowntree, S. Walter Ranson, Andrew C. Ivy, James Persons Simonds, Allen B. Kanavel, William H. Holmes, Charles A. Elliott, Harry M. Richter, Harry Malcome Hedge, Michael L. Mason, Don C. Sutton, Edouard E. Lyon, and Paul Starr.

PART THREE

DEDICATORY

DEDICATION ADDRESS[1]

Archibald Church Medical Library

By IRVING S. CUTTER, Sc. D., M.D., CHICAGO

Dean, Northwestern University Medical School

LIBRARIES are the storehouses of thought; the granaries, as it were, of the mind; the quiet places where, instinctively, all else is extra-territorial save the method and manner of study. The student turns to the library for the rich store of recorded knowledge and finds at his immediate command the productive scholarship of the centuries.

The scope of the medical library is far wider than would appear at first thought—wider than any single science, for medicine in the broadest sense embraces all science. Founded upon the fundamental sciences of physics, chemistry and biology, with the natural correlating sciences of physiology, anatomy, biological chemistry and pharmacology, drawing heavily upon physical chemistry, bio-physics and bio-metrics, medicine is not yet able to determine what takes place under many conditions of disease. Investigators then in their attack upon the multitude of unsolved problems in medicine need to have at their command a library of unusual richness and of the widest scope.

The laws of society, of economics, operate in a given way—at a given time, in definite relation to the state of medicine and of sanitary science. One has but to recall the widespread and sweeping epidemics of the middle ages, even those of the 17th and 18th centuries, to visualize their effect upon society, commerce, and even the very existence of nations. With the span of life of the present generation lengthened a dozen or more years, we may confidently predict further safeguards and security to life. Industrial development, transportation problems, urban concentration of population, the elimination of widespread epidemics, such as cholera, smallpox, typhus fever, diphtheria, typhoid and the like, and many other factors are bringing entirely new problems to medicine. The history of the future can be predicated only upon an intensive study of the history of the past with its clearly defined mass movements. The student of medicine is not confined in a so-called "water tight" compartment, existing only in and of his immediate problems. Of *all* the professions *his training* and outlook must be the broadest, his reading far wider than his specialty and his social and personal contacts with every stratum of society; with personalities

[1]See bas-relief of Dr. Archibald Church, page 38.

representing every vagary of the human mind. History, economics, sociology and psychology must enrich in a large degree the general education of the physician, and the scope of his library contacts during his student days must embrace all these and even more. Reading habits of reasonably wide range engender thinking habits, and these habits of thought formed during the minimum course which the student must take will stamp him as a scholar and a potential leader of society.

In this library the student may meet as living personalities, may rub elbows with, and chat at will with the great masters of medicine of all generations—Hippocrates, the father of medicine, to whose inspiring oath of service all graduates in medicine in all lands today subscribe; Sydenham, the great observer and clinical teacher; Pasteur, father of the science of bacteriology; Morgagni, the founder of pathology; Virchow, the founder of cellular pathology; Koch, the discoverer of the tubercle bacillus; Pinel, the great reformer in the treatment of the insane, and Victor Horsley who developed modern surgery of the brain. Here will be found the works of Harvey, the English student at Padua, the immortal discoverer of the circulation of the blood; the works of John Hunter and his brother, William Hunter; and the student can receive direct inspiration from the early physiological experiments of John Hunter and later learn from the same source the true experimental method in surgery. Here will be found the works of the first great anatomist, Vesalius, and what student can but be thrilled at the marvel of his superb dissections and the beautiful plates of Jean Calcar! The works of Mead, of Fothergill, the clinics of Stokes, of Graves, of Trousseau, of Corrigan, all rise before him with a startling and compelling challenge.

Here the student may read that masterpiece of Oliver Wendell Holmes "On the Contagiousness of Puerperal Fever" in which Holmes with incisive logic conclusively proved, long before the discovery of bacteria, the contagiousness of that terrible scourge of motherhood. And then perhaps the student will run across the lines in the "Professor at the Breakfast Table" where Holmes says: "By the permission of Providence, I held up to the professional public the damnable facts connected with the conveyance of poison from one young mother's chamber to another's,—for doing which humble office I desire to be thankful that I have lived, though nothing else good should ever come of my life,—I had to bear the sneers of those whose position I had assailed, and as I believe, have at last demolished, so that nothing but the ghosts of dead women stirs among the ruins." Rarely are the library contacts of the student unproductive. He is soon fired with idealism, his imagination is developed and new ideas are born.

The recorded results of the work of centuries of biological investigation, every book and printed pamphlet, is of potential value. The tiny grain of truth hidden away in some well-nigh forgotten treatise, in the light of modern knowledge, may start new processes of thought that will revolutionize the life of nations. What Pasteur and later, through Pasteur, what Lister accomplished, may be definitely traced to the earlier fundamental experiments of Francesco Redi and Spallanzani. Every book in this library will be called for, some daily, others not once a year, yet when the call comes *it is insistent.* Only a particular volume can supply the answer.

Those of us who have not known the living Davis and Hollister, Rutter, Edmund Andrews, Byford, Johnson, Isham, Ray, Senn, Long, Fenger, Murphy and scores of others have lost the personal inspiration of their teachings, but we have reformed

in memory their personalities, and their printed words come to us as clearly as did their spoken words to students of a generation or more ago. We are doubly grateful that we have known, but to lose all too soon, such rare men, internationally eminent in their fields, as E. Wyllys Andrews and Thomas J. Watkins. That these men and others like them may live for all succeeding generations, there must be preserved in this library every line of their scientific productions, every bit of manuscript, every picture, personal letter, and anecdote, and preserved in such a way as to be available always and ever in the consciousness of the students of this school. The precepts and example of great teachers never die. Acquired by the student of this generation they become *his inspiration,* as *he in turn* becomes the *teacher of the coming generation.* The impress of the teaching and personality of Nathan Smith Davis upon this present faculty is an omnipresent and real thing. Frank Billings, graduating in the class of 1881 from this school, received his fundamental stimulus from the great teachers of his day. This he has multiplied an hundredfold and has passed on in large measure to the students who have come under his inspiring guidance. What monument is it possible to create of more stately architecture, more brilliant outline, more enduring character than the planting of ideals, the stimulating of the desire to study, and the creating in youth of the power to think. And so this library must become a veritable storehouse, not only of the printed results of scientific investigations the world over, but also of those things which will preserve for all time the personalities, even the peculiarities and ideals of our great teachers.

Northwestern University Medical School is destined to achieve and, *measured in terms of production,* trained physicians and research will result. The physical plant—this beautiful building and its equipment—must be adequately manned with able teachers, thorough scientists, capable of kindling with the power of truth the minds and the imaginations of students. *The heart of this as of any institution of higher learning is its LIBRARY,* a library so complete, so broad in scope, so accessible that it will satisfy the most eager student mind and the needs of the most exacting scientific research.

By order of the Board of Trustees of this University, this library, in recognition not only of the endowment provided therefor, but in DEEPER RECOGNITION of his *loyalty* and *devotion to the school,* his *outstanding qualities* as a *teacher* and *practitioner,* his scientific attainments, his scholarship,—is *now and henceforth* to be known as the Archibald Church Library of Northwestern University Medical School. In addition to the endowment provided by Dr. Archibald Church and his wife, Margaret Finch Church, there have been received productive endowments in substantial sums from Augusta Elizabeth Lehmann and Joseph B. DeLee. From many other friends, including Dr. Arthur H. Curtis and the Alumni Association of the Medical School, substantial annual contributions have been received. Gifts of books of great value deserve special mention. From Mrs. Mary C. Halstead has been received the entire surgical library of her husband, the late Albert E. Halstead of the class of 1890. This splendid collection is now housed in one of the seminar rooms of this library and by order of the Board of Trustees of the University is to be known as the Albert E. Halstead Surgical Library. Collections of unusual value have been received from Dr. Otto L. Schmidt of the class of 1883; Dr. Louis E. Schmidt, Professor of Urology; Dr. Charles A. Elliott, Professor of Medicine; Dr. E. C.

Dudley, Emeritus Professor of Gynecology; from the family of Dr. Ralph N. Isham and Dr. George Isham, and from many others.

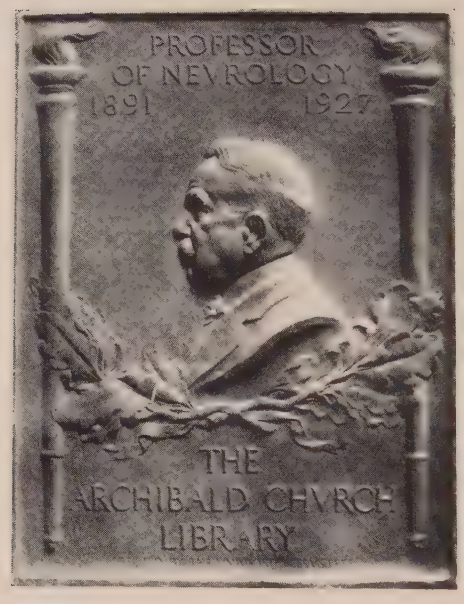
Mention may also be made of the Mayo lectureship founded by Dr. Charles Mayo of the class of 1888, for this is essentially a library function. This lectureship makes provision for an annual lecture on the progress of surgery, the published lecture to be placed in the library of the School. Under this foundation the first lecture will be delivered by Dr. Charles Mayo in 1928.

The first mention of the Library of the Medical School is made in the University Bulletin for 1864–65, wherein it is credited with having about 1,000 bound volumes and the leading medical periodicals of the time. It would appear that these periodicals were not bound and made a permanent part of the library at that early date, for, with the exception of the *Journal of the American Medical Association,* the *American Journal of Medical Sciences,* and one or two foreign journals, there are no bound journals of those years bearing the library stamp now in the library.

Under the stimulating leadership of Dr. George W. Webster, chairman of the faculty committee on library, through donations from the faculty and alumni, and by purchase, the number of volumes increased to 4,000 by 1905, and to 10,000 by 1916. Between 1916 and 1925, some 3,000 bound volumes were added. During the past few years Dr. A. A. Day has been chairman of the faculty library committee. There have been accessioned to date in excess of 22,000 bound volumes, an increase of 9,000 volumes during the last two years. There are in addition more than 10,000 unbound volumes, pamphlets, reprints and theses of which more than 3,000 have been added during the last two years. The library regularly receives 175 medical journals of which number 100 have been added since 1925. We may with confidence anticipate the time not far distant when this library will number at least 100,000 bound volumes, with a subscription list of medical and scientific periodicals approximating 400.

Carved upon the façade of this beautiful Ward Memorial Building are these words of William Harvey: "I profess both to learn and to teach from the fabric of nature." No sentence ever penned, of so few words, tells *so much* of the method and ideals of science. Theories, No! Speculative philosophy, No! Imagination, Yes! and experiment, searching the "fabric of nature." William Harvey returning from Padua taught his doctrine in London and demonstrated his experiments, but for sixteen long years his teaching was without result until in 1628, the publication of his book, *De Mortu Cordis,* brought before the world, *with startling brilliance,* his sound scientific evidence. It was the *publication* of his observations and experiments—the printed page—available to scholars the world over, that rendered his discoveries of common knowledge and led to their world wide acceptance. The researches of the isolated scholar in his cloistered cell—even though he discover *all truth*—will avail nothing to the world unless his work shall find a place in the store houses of knowledge—our libraries.

As the Faculty of Medicine we dedicate this library to service, in the conquest of disease; to the extension of the boundaries of human knowledge, to the stimulation of scholarship and to the preservation of the ideals and personalities of true teachers of science of all ages and in all lands. We do this with a deep sense of appreciation, and we record our gratitude to Archibald Church and Margaret Finch Church and *to all others* who by their *interest, co-operation and support have aided in its creation.*



ARCHIBALD CHURCH

Unveiling of Bas-Relief[1]

By WILLIAM A. DYCHE, M.A., Chicago

Trustee and Business Manager, Northwestern University

For seventy years the faculties of Northwestern University have rendered great service to Chicago and the middle west. These seventy years cover a large portion of the existence of this great city and the region hereabouts.

For thirty-five years—half the life of Northwestern University—Archibald Church has been a distinguished member of its faculty in Medicine. As a teacher he has inspired thousands. As the author of a textbook on mental and nervous diseases he has made himself known to the men of other medical schools, for this book has gone through many editions and today is used in a majority of the medical schools in this country. As a practitioner of great skill he has brought relief to many in distress.

But Dr. Church has been something more than an inspiring teacher, an author of renown, a practitioner of great service; he has been a scientific investigator in his chosen field. He is known here and abroad. He is an honor to the medical profession of the world.

[1]Bronze bas-relief of Dr. Church designed by Leonard Crunelle and erected in the Archibald Church Medical Library by order of the Board of Trustees of Northwestern University.

One of the greatest benefactors of Northwestern University, a man now in his eighty-sixth year, said the other day, "Wealth is a convenience, friendship is a necessity." Dr. Church has been supplying this necessity of friendship all his life; he has an army of loving friends.

Dr. and Mrs. Church are big hearted and have a great vision of service. They do not intend that Dr. Church's work shall stop when he is no longer personally able to carry on. Therefore they have endowed this library, which is honored with the name of Archibald Church. It is a home of service for students and practitioners. I have no hesitancy in predicting that some from his army of friends will add to its endowment so that eventually the Archibald Church Medical Library will become one of the great working medical libraries in this country.

Northwestern University has great appreciation of Dr. Church's services, continued for so many years. Words are inadequate to express the depth of its debt to him. His name will ever be held sacred in its annals.

Mr. Leonard Crunelle, a sculptor of note, was asked by the trustees to make a bronze *bas-relief* of Dr. Church and he has complied with their wishes. This relief will hang on the walls of this library for years to come as a token of the appreciation of Northwestern University of this man, a token visible to those of today and to those who follow.

Now, in the name of the University, it is my privilege to unveil this *bas-relief* of Archibald Church.

Archibald Church. Born at Fond du Lac, Wisconsin, March 23, 1861. M.D., College of Physicians and Surgeons, Chicago, 1884. Assistant Medical Superintendent, Illinois State Hospital for the Insane, 1884–88. Professor of Nervous and Mental Diseases, Northwestern University Medical School, since 1892. Consulting Neurologist, St. Luke's Hospital; Senior Attending Neurologist, Michael Reese Hospital; Emeritus Neurologist, Wesley Memorial Hospital; Neurologist, Chicago Lying-In Hospital and Dispensary. Editor, Chicago Medical Recorder, 1895–1900. President, Chicago Medical Society, 1923–24. Author: Textbook on Nervous and Mental Diseases, 1898; and over fifty contributions to medical literature.

NATHAN SMITH DAVIS

Unveiling of Portrait

By NATHAN SMITH DAVIS, III., M.D., Chicago

Associate in Medicine, Northwestern University Medical School

In the brief time at my disposal, it would be impossible to give even an adequate outline of the life of Nathan Smith Davis, M.D., A.M., LL.D., whose portrait has just been unveiled. He was an active power in the medical profession of this country during most of the sixty-seven years of his medical practice. When twenty-eight years old, he founded the American Medical Association and later was its president for two years. He was active in the organization of the Chicago and Illinois State Medical Societies, the Chicago Historical Society, the Chicago Academy of Sciences, the Illinois State Microscopical Society, the American Association of Medical Colleges, the Medical Editors' Association, and Northwestern University. The Medical Department of Lind University (later the Chicago Medical College and now Northwestern University Medical School) was founded that his ideas on medical education might be put into operation. He was for years an officer of many of these organizations; a trustee of Northwestern University for nearly fifty years; and president of the Ninth International Medical Congress, which met in Washington in 1887. In addition to being a great organizer and pioneer educator, he was an inspiring teacher,

a voluminous writer, an able investigator, and an editor of wide experience. He was the first editor of the *Journal of the American Medical Association* and was really responsible for its inception to replace the annual *Transactions of the Association.* Always active in the affairs of the community in which he lived, especially in the promotion of sanitation and public health measures, he founded our first general hospital, what is now Mercy Hospital, with the proceeds of a series of public lectures on the sanitary needs of Chicago.

An account of his early life and education based on a letter to his daughter-in-law, Mrs. Frank Howard Davis, written December 16, 1893, and on an unfinished autobiographical sketch in my possession, is of interest.

Nathan Smith Davis, was born on January 9, 1817, in the town of Greene, Chenango County, New York, in a log cabin on a farm only partially cleared of the original forest. He was the youngest of a family of seven, four girls and three boys. His parents, Dow and Eleanore (Smith) Davis were among the pioneer settlers of Chenango County. Dow Davis lived to be ninety years old but his wife, Eleanore Smith, died at forty-eight, when her youngest son was seven. Of his mother, Dr. Davis wrote:

> My mother as I remember her, was rather tall and slender and of decided nervous temperament, thoroughly devoted to her family and domestic duties, an earnest member of the Methodist Episcopal Church, and made her house the stopping place for the ministers when they came around on the circuit to preach, once in three or four weeks, in the district school house. When conscious that the end of this life was near, she called her children one by one to her bedside and gave to each her farewell words and blessing. As I was the youngest, my turn came last, and though her words have long since faded from my memory, the scene is still vivid and the blessing has never ceased to exert a happy influence over my whole life.

The youngest son of Dow and Eleanore (Smith) Davis was named after a maternal uncle, Nathan Smith, a prosperous farmer who lived a few miles north of Greene, and not after the famous Dr. Nathan Smith (1762-1829), who founded Dartmouth and Yale Medical schools. Until 1833, he worked on the farm during the eight warmer months and attended the district school during the four winter months. Each year increased his longing for additional educational advantages and caused him to spend a large part of the rainy days and of his leisure hours in reading whatever books he could procure, rather than in hunting and fishing with his comrades. In the little school nearest his home only spelling, reading, writing, arithmetic and geography were taught. So during the winter of 1832-33, he walked two miles morning and evening to attend the school in the next district where English grammar and natural philosophy were taught and where better instruction was given in the ordinary branches. I distinctly remember hearing him say that on reaching school he often had to put his lunch by the fire to thaw it out, because it had frozen on the way over. In a letter he said:

> In April, 1833, while my father, brother and myself were busy repairing a rail fence by the roadside, Dr. Daniel Clark, our family physician, came up the road on horseback and as he passed asked my father in a jovial way if he intended to make a pill-peddler of me. Father replied in the same spirit that he presumed I would make as good a tin-peddler as anything. The doctor rode on laughing and the incident received no further attention until the summer's work had been nearly completed and the autumn of 1833 was at hand. Then while my father and myself were busy one afternoon in building a stone wall to replace an old rail fence, he surprised me by the deliberate statement that he had decided to let me choose between remain-

ing on the farm permanently and, when old enough to need it, have a farm of my own in the neighborhood, or going to Caznovia Seminary for six months and then entering the office of Dr. Clark for studying medicine three years, for which he would furnish $100.00 each year and my clothes, after which I would be obliged to support myself. Of course, my anxiety for better education caused me promptly to choose the latter, while the conversation showed plainly that the doctor's remark about making a pill-peddler of me had been engaging his attention all summer.

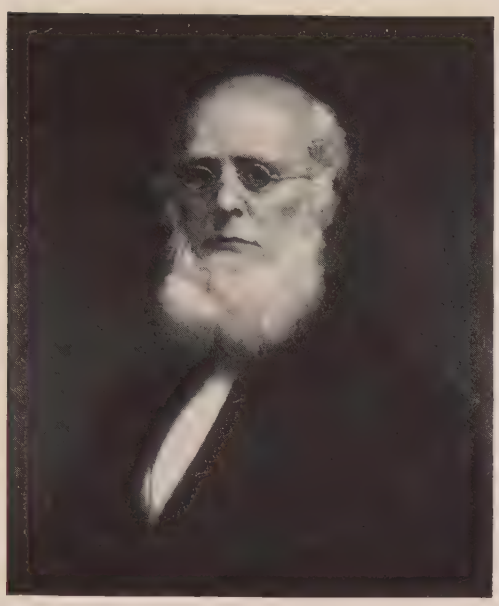
So Nathan Smith Davis attended the fall and winter terms of Caznovia Seminary and gained a more complete knowledge of natural philosophy and chemistry and some Latin. In the spring of 1834, he entered the office of Dr. Daniel Clark in Smithville Flats as a medical student. In order to save as much of the $100.00 as possible so as to enable him to attend a medical school, he boarded with the doctor, a newlywed, and in part payment took care of his horses, milked the cows, and did other chores.

In October, 1834, he matriculated at the College of Physicians and Surgeons of the Western District, located at Fairfield, Herkimer County, New York. This college then had an excellent faculty composed of T. Romeyn Beck, James McNaughton, John Delamater, R. D. Mussey, James Wadley, and Westal Willoughby. At the close of the first term, Davis entered the office of Dr. Thomas Jackson of Binghampton, New York, and continued as his pupil until he graduated at the close of the third term of lectures at the age of twenty years and twenty-two days, January 31, 1837. His graduation theses on *Animal Temperature,* in which he attempted to disprove the then prevalent doctrine concerning the union of oxygen and carbon in the lungs, was one of the four selected to be read on commencement day.

In closing I wish to quote from his address at the opening of the Medical Department of Lind University, October 9, 1859, in which the considerations that induced the faculty to undertake the establishment of that institution, of which this is the direct descendant, were clearly stated:

> First, the very liberal offer of the Board of Trustees of the University to furnish all the needed accommodations for a medical department, with no other restrictions than the plan of instruction adopted should be such as would most effectually promote the educational interests of the profession without reference to established customs or usages.
>
> Second, a sincere desire on the part of the faculty to put into practical operation a system of medical college instruction more in accordance with sound educational principles and better adapted to the present state of the science and art of medicine than that which has been long adhered to by the medical schools of the country.

NATHAN SMITH DAVIS. Born in Greene, Chenango County, New York, January 9, 1817. M.D., College of Physicians of Western New York, 1837. Instructor of Anatomy, College of Physicians and Surgeons, New York, 1847. Professor of Physiology and Pathology, 1849; later Professor of Principles and Practice of Medicine and Clinical Medicine, Rush Medical College. One of the founders, 1846; President, 1864–65, American Medical Association. One of the founders; senior member of the staff for nearly 40 years, Mercy Hospital. Founder, Chicago Academy of Sciences; Chicago Historical Society; Illinois State Microscopical Society; Washingtonian Home. One of the founders, Medical Department of Lind University (later the Chicago Medical College), 1859. Professor of Medicine, 1859–91; Dean of the Medical School, 1872–98; Emeritus Professor of Medicine, 1892–1904; Emeritus Dean, 1899–1904, Northwestern University Medical School. Trustee for nearly 50 years, Northwestern University. Organizer; President, 1855, Illinois State Medical Society. Organizer; President, 1854–56, 1857–58, Chicago Medical Society. Editor, Journal of the American Medical Association, 1883-89. Editor: Chicago Medical Journal, 1855–59; Northwestern Medical and Surgical Journal; Eclectic Journal of Education and Literary Review; American Medical Temperance Quarterly. Founder, 1860; Editor, 1860–73, Chicago Medical Examiner. Secretary-General, Executive Committee, 1887; later President, International Medical Congress. Author: Lectures on the Principles and Practice of Medicine; A History of Medical Education and Institutions of the United States; Clinical Lectures on Various Important Diseases. Died, June 16, 1904.



DAVID RUTTER

Unveiling of Portrait

By MISS EMMA TURNLEY, Highland Park, Illinois

Granddaughter of David Rutter

David Rutter was born at Pine Forge, Berks County, Pennsylvania, December 23, 1800, in the old stone house built in 1714 by Thomas Rutter on land obtained by original patent from William Penn.

Thomas Rutter built and operated several forges and furnaces in that neighborhood, but Pine Forge is said to be the oldest. The Mansion House, as it was called, was occupied and the forge operated by seven successive generations of the Rutter family, and is at present in the possession of William NcN. Rutter, a grandson of David Rutter.

In 1823 David Rutter received his degree of Doctor of Medicine from the University of Pennsylvania. His graduation essay was written on the subject of *Ardent Spirits,* the indiscriminate use of which he opposed personally and professionally.

A year after graduation, Dr. Rutter married Isabella Crawford, who lived for only a few years. One son of this marriage, Rhea Barton Rutter, graduated at the age of nineteen from the Jefferson Medical School of Philadelphia, giving much promise of ability. He died in 1853 during the cholera epidemic in Chicago.

In 1837 David Rutter married Esther Turner Ryerson of Philadelphia. By this marriage there were six children.

For nine years Dr. David Rutter practiced his profession in Montgomery County, Pennsylvania, and then moved to Philadelphia where he established a large general practice, and specialized in obstetrics. His intimate associates in Philadelphia were Drs. Meigs, Pancoast and others whose names I do not recall.

In 1849 he came to Chicago and lived in the house prepared for the family by Mrs. Rutter's brother, Mr. Joseph Ryerson, who for some time had strongly urged them to make a new home here. The house, a typical Philadelphia three-story red brick structure, stood on the northwest corner of Wabash Avenue and Madison Street.

While my grandfather continued the practice of medicine, his broken health, which was in large part the reason for his coming to Chicago, prevented him from continuing the arduous labors of his Philadelphia career. However, he was constantly called in consultation by his associates, who valued his judgment in diagnosis.

In 1859 Dr. Rutter was actively associated with Drs. Johnson, Byford, Davis, Hollister, Andrews, and Isham in founding and organizing the Medical Department of Lind University. Dr. Rutter was made Professor Emeritus of Obstetrics of Northwestern University Medical School and headed the faculty list for many years.

On April 16, 1865, Dr. Rutter died of apoplexy resulting from the excitement and distress occasioned by the assassination of President Lincoln two days before. He had always been a man of strong feeling with regard to public as well as personal affairs and he greatly feared the consequences to the Nation of Mr. Lincoln's untimely and tragic death. Dr. Rutter, before his death, paced the length of the long double parlors in his home repeating over and over again, "The country is lost!"

Because of my intimate association with my grandfather during my childhood and because I cherish many happy recollections of this association I feel the sincerity and truth of the words of Dr. Nathan S. Davis spoken publicly shortly after my grandfather's death:

> On this sad occasion of meeting to take suitable action in relation to the death of one of our members, I feel constrained by a sense of duty as well as pleasure to give testimony to the worth and purity of the deceased. Little need be said relative to his talent, virtues and ability which are so well known to the brothers of his profession. Dr. Rutter was one of the oldest, most esteemed and best loved among us. With a mind acute, active and enlarged by liberal study, a heart kind and sympathetic, a disposition gentle and forgiving. He was always studiously observant of the rules and etiquette of the profession and unusually courteous to all. In his lectures to the students in college, Dr. Rutter had never failed to inculcate the most exalted lessons of morality while giving invaluable professional instruction. A beloved physician and Christian gentleman.

I should like to say a word of appreciation of this opportunity afforded us, the descendants of these men of the "old school," to preserve the physical likenesses as well as the professional achievements of our grandfathers. They are reminders of the past in the midst of the ever-changing present and the progressive future. We are indeed grateful to those who have thus honored them.

DAVID RUTTER. Born in Pine Forge, Pennsylvania, December 23, 1800. M.D., University of Pennsylvania, 1823. Practiced, Montgomery County, Pennsylvania, 1823–32; Philadelphia, 1832–34; Chicago, 1849. One of the organizers of the Medical Department, Lind University (later the Chicago Medical College), 1859. Professor of Obstetrics, later Emeritus Professor of Obstetrics, Northwestern University Medical School, 1859–65. Died, April 16, 1865.

WILLIAM HEATH BYFORD

Unveiling of Portrait

By HENRY T. BYFORD, M.D., Chicago

Professor Emeritus, University of Illinois College of Medicine

Dr. William Heath Byford died thirty-seven years ago, and I am probably the only one living who knew him well enough and long enough to speak of his life from personal knowledge.

The first event in his career that I remember was riding on horseback behind him in 1857, when he was on his way to make a professional call near Evansville, Indiana. At that time he had been practicing general medicine for twenty years in Ohio and in southern Illinois and Indiana.

Upon the death of his father he was taken out of school when nine years old to help support his mother. But he procured textbooks and never ceased systematic studying until he had acquired what was called a good education, including some knowledge of physiology, chemistry, natural history, Latin, a smattering of Greek, and later a working knowledge of German. He then studied medicine in the office of Dr. Joseph Maddox of Vincennes, Indiana. When twenty-one years old he passed the customary examination and was licensed to practice medicine. He attended lectures later, and graduated from the Ohio Medical College in 1845.

In 1847 he performed two cæsarean sections. In 1850 he was elected Professor of Anatomy in the now extinct Evansville Medical College, and in 1852 was transferred to the chair of Theory and Practice. In 1857 he was elected Vice-President of the American Medical Association. In 1858 he was called from Evansville to the chair of Obstetrics and Diseases of Women and Children in Rush Medical College. In 1859 he joined Doctors Davis, Andrews, Johnson, Isham, Rutter, Hollister and others in organizing the Medical Department of Lind University (later the Chicago Medical College) with a graded three year course of instruction. In 1870 he was the leader in founding the Woman's Medical College of Chicago and was the president of its faculty and of the Board of Trustees until his death in 1890.

In 1879 he surprised the faculty and friends of the Chicago Medical College by accepting a call to the Chair of Gynecology in Rush Medical College. His reason for this step was that he could not give lectures and clinics at the Chicago Medical College and Mercy Hospital on the south side and continue his work at the Woman's College on the west side, but he *could* lecture at both Rush and the Woman's College because their buildings and hospitals were close together.

He was a prodigious worker. In addition to his duties in two colleges he organized the Woman's Hospital of Chicago and was its president and main support while he lived. He was a prolific writer. His early articles in the journals led to his first call to Rush College. In 1864 he wrote the first medical book by a Chicago author. Its title was *Chronic Inflammation and Displacements of the Unimpregnated Uterus.* In 1866 appeared his book on *Diseases of Women.* In 1869 his *Philosophy of Domestic Life* was published, and in 1872 his work on *Obstetrics.* He was the editor of a medical journal in Evansville in his younger days. For several years he was associated with Dr. N. S. Davis, I, in editing the *Chicago Medical Journal,* and was later the editor-in-chief of the *Chicago Medical Journal and Examiner.*

In concluding this fragmentary record I feel that I would not have truly represented his character without recalling the fact that he never lost that touch of nature which was characteristic of the old time country practitioner. His patients worshipped him and he loved them like a father. Even after assuming the burdens of a busy specialist and college teacher and organizer, he indulged almost to the end in a little general practice among his old patients. His high ideals of service as exemplified in both precept and performance inspired his students to strive for something more than mere science and art.

He died in the harness. On a Monday afternoon he performed a major operation and on the following Wednesday he died.

WILLIAM HEATH BYFORD. Born in Eaton, Ohio, March 20, 1817. Apprenticed to a tailor, 1831–37. M.D., Ohio Medical College, 1845. Professor of Anatomy, 1850; Professor of Theory and Practice of Medicine, 1852, Evansville (Indiana) Medical College. Professor of Obstetrics and Diseases of Women and Children, Rush Medical College, 1858. One of the founders, 1859; Professor of Obstetrics and Diseases of Women, 1859–79, Chicago Medical College (later Northwestern University Medical School). Professor of Gynecology, Rush Medical College, 1879. Vice-President, American Medical Association, 1857. One of the founders, President of the Faculty, Woman's Medical College of Chicago, 1870–90. One of the founders, 1876; Vice-President, 1876; President, 1881, American Gynecological Society. President, Chicago Gynecological Society, 1878. Editor: Chicago Medical Journal; Chicago Medical Journal and Examiner. Author: Cæsarean Sections, 1847; Chronic Inflammation and Displacements of the Unimpregnated Uterus, 1864; Died, May 21, 1890.

JOHN HAMILCAR HOLLISTER

Unveiling of Portrait

By FRANKLIN H. MARTIN, M.D., LL.D., Chicago

Member of the Board of Trustees, Northwestern University

John Hamilcar Hollister was born in Riga, New York, August 5, 1824. Two years later his father, a civil engineer, moved his little family to Romeo, Michigan, where he died in 1831. His widow was left with three little children, the eldest being John, then seven years of age.

Romeo was a fine town of the old New England type and possessed an excellent academy. Here the boy received his early education until, in 1840, he went east and attended first the Jordan Academy conducted by Professor Stowe, and later the Rochester Collegiate Institute, from which he graduated with honors in 1842.

Upon returning to Romeo he soon made his decision to become a physician and for three years he taught school during the winter, and studied during the summer months with Dr. J. P. Whitney. In July, 1846, he entered the Berkshire Medical College at Pittsfield, Massachusetts, then ranking as one of the most desirable schools. The course consisted of two terms of lectures given annually from August 1 to November 15, with all students attending the same lecture and with absolutely no clinical facilities. On his twenty-second birthday he heard his first lecture delivered by the renowned Professor Alonzo Clark of New York, and on November 7, 1847, he

received his degree of Doctor of Medicine and was selected as one of three to read an original medical thesis in public.

On January 2, 1849, he married Jennette Windiate and immediately settled in Grand Rapids, Michigan, where he remained for six years.

In 1855, strongly influenced by the advice of his life-long friend, Edmund Andrews, he came to Chicago, and in 1856 was appointed Demonstrator of Anatomy at Rush Medical College. Here he associated himself with a group of young men destined to prove themselves giants in their profession.

It was in 1859 that six young men full of youthful courage and enthusiasm and fired with the glory of a new ideal determined to embark upon a great adventure—an adventure which meant the founding of a new medical school and the revolutionizing of the methods of medical teaching the world over. It was no mean decision which these young men were called upon to make, for failure spelled for them disaster—financial, social and professional. But they did not fail. Lind University Medical School became an accomplished fact and Andrews, Johnson, Byford, Hollister, Isham, and Rutter (joined two years later by Davis) established the school which has now become the Medical Department of Northwestern University and thereby laid the foundation stone of the beautiful home which is being dedicated today.

From that time on Dr. Hollister was in active medical service. He occupied the chairs of Materia Medica and Physiology, and Public Hygiene in Lind University until in 1863 it became the Chicago Medical College. From 1863 to 1895 he was Professor of Clinical Medicine in the Chicago Medical College and Mercy Hospital. From 1895 to 1911 he was Professor Emeritus of Clinical Medicine in the Chicago Medical College and Mercy Hospital. He was also during most of that time a trustee of the College.

He served a number of years at Cook County Hospital acting as Chairman of the Medical and Surgical Staff. During the Civil War he had charge of the Medical and Surgical Department of Soldiers' Home, and under Colonel Mulligan served as surgeon to Camp Douglas.

He joined the Chicago Medical Society in 1855 and held continuous membership during his life.

In 1857 he was elected to the Illinois State Society and acted as its Treasurer for twenty-two consecutive years with the exception of the year 1875 when he was its President.

His association with the American Medical Association began in 1858 and continued during his life. For eight years he served as trustee and for two years as the editor of its journal. In 1888 at Cleveland he presided over the Medical Section of the Association.

The honorary degree of Master of Arts was tendered him by Beloit College.

He was an early member, if not one of the founders, of the Chicago Historical Society, a member of the Academy of Sciences, an officer of the Young Men's Christian Association, a member of the New West Commission, the City Mission Society, the Congregational Club, and various other organizations.

In addition to his large medical practice he found time for much religious and church work. From mission schools, which he either founded or superintended, have developed the Union Park Congregational Church, the Tabernacle Church (which

later became united with the Chicago Commons), the Clinton Street Church, and finally the Plymouth Mission, which formed the nucleus of the great Armour Mission and its School of Technology.

Mrs. Martin will unveil the portrait of her father.

Remarks at Unveiling Ceremony

By ISABELLE HOLLISTER MARTIN, Chicago

Daughter of John Hamilcar Hollister

May I add a few words to what Dr. Martin has already said, expressive of the deep gratitude I feel in being allowed to present this portrait of my father to the Medical Department of Northwestern University and thus associate him once more a little more intimately with the institution which he struggled so valiantly to found, and which through all the years of his life he so devotedly honored and loved.

For me this day is full of very vivid and precious memories. The men whom you are seeking to honor as founders of this great medical school are each of them associated with the recollections of my very earliest childhood and with all my younger years. To me they were loving friends, who, while they struggled earnestly and honestly with the various problems by which they were beset, still had time for a merry jest or a bit of play with a little child.

One thing I wish to emphasize especially—do not remember these men solely as they may have appeared to you in these latter years, as men of achievement and assured position, but think of them also as young men filled with youthful enthusiasm for the fulfillment of a wonderful dream and blazing the difficult trail over which the men of today are speeding so rapidly. Remember as you think of them that it is the courage and vision of yesterday that underlies and makes possible the courage and vision of tomorrow.

Therefore, with deepest reverence I unveil for you the portrait of my father who gave his youth, his middle age, and his old age to the service of Northwestern—John Hamilcar Hollister.

John Hamilcar Hollister. Born in Riga, New York, August 5, 1824. M.D., Berkshire Medical College, 1847; M.A., Beloit College. Demonstrator of Anatomy, Rush Medical College, 1856. One of the founders, Medical Department of Lind University (later, Chicago Medical College), 1859. Professor of Physiology, Anatomy, Pathological Anatomy, and General Pathology, 1859–95; Professor Emeritus of Clinical Medicine, Northwestern University Medical School. Trustee, Northwestern University for many years. Surgeon; Clinical Professor for 20 years, Mercy Hospital. Chairman of Medical and Surgical Staff for many years, Cook County Hospital. President, 1875; Treasurer for 22 years, Illinois State Medical Society. President, Chicago Medical Society, 1882. Charter Member, Chicago Academy of Sciences. Trustee for 8 years, American Medical Association. Editor for 2 years, Journal of the American Medical Association. For more than 50 years a member of the Plymouth Church, Chicago. President, Y. M. C. A.; Congregational Club; Chicago Bible Society. Director, Illinois Home Missionary Society. Surgeon-in-chief, Soldiers' Home; Surgeon at Camp Douglas under Col. Mulligan during the Civil War. Died at Redlands, California, December 13, 1911.

ROBERT LAUGHLIN REA

Unveiling of Portrait

By ARCHIBALD CHURCH, D.Sc., M.D., Chicago

Professor of Nervous and Mental Diseases, Northwestern University Medical School

With reverent pride I unveil this excellent portrait and remarkable likeness of Robert Laughlin Rea. I cannot believe that his equal as a teacher of descriptive human anatomy has ever stood before a medical class. Standing much over six feet straight above his heels, with his eyes deep-set under a classic brow, he seemed to his students to glow with the inward fires of his enthusiasm.

For him every assigned hour was a sacred duty. He was never late. For a portion of an hour before every lecture he paced the narrow limits of the waiting room and at the last stroke of the announcing bell stood before his class. A moment of dignified silence and the subject was taken up. Rhetorical embellishment and oratorical effort never impaired the lucidity of his presentation. Anecdote and innuendo had no place in his lectures and even for the saving grace of humor he seemed to have neither time nor tolerance. However, he did not allow his students to perish in the dry Sahara of an endless terminology. He ever kept before them the integrity of his subject and the application of anatomical facts to the understanding of the human organism and the needs of medicine and surgery. With comparisons as clear cut as the lines of an

Etruscan vase he made his students realize the unity of his anatomical descriptions.

I recall his opening remarks on the circulatory system. He likened it to a beautiful pyramid, broadly and deeply based on a layer of capillaries which, though microscopical in size, reach every fibre and cell of the living tissues; above this a layer of venules and arterioles, surmounted by larger veins and arteries and in turn by the great arterial trunks and venous passages; and capping all, the heart itself, which in apparently sleepless activity, beating more rapidly than the seconds of measured time, goes steadily on for all the hours and days and months and years of human life, pouring forth a flood of purified and vivifying blood to every structure and atom of the body.

Even the dry bones of osteology were paraded before his students as an animated whole, furnishing protecting cavities for the vital organs and a foundation for the overlying parts that give the gracious contours of the human form.

For the sluggish student he was a kindly goad, for the dishonest and indifferent student a walking terror, for those of better endowment and studious bent a flaming inspiration.

It is a matter of peculiar satisfaction that proceeds of his professional activity, through the intelligent generosity of his wife, have been used to endow the Robert Laughlin Rea Professorship of Anatomy. The efforts of his high vocation are thus to be continued forever.

As in years that are gone, I bow to this superlatively great teacher, to this majestic man.

ROBERT LAUGHLIN REA. Born in Rockbridge County, Virginia, July 1, 1827. Read medicine with Dr. W. P. Kitchen, Brownsville, Indiana. Practiced, Oxford, Ohio, 1851. M.D., Ohio Medical College, 1855. Demonstrator of Anatomy, Ohio Medical College, 1855. Resident Physician, Commercial Hospital of Cincinnati, 1855. Professor of Anatomy, Rush Medical College, 1859–75. Physician, City Hospital, 1862–63. Professor of Anatomy, Chicago Medical College, 1875. Professor of Surgery and Clinical Surgery, College of Physicians and Surgeons, 1882–86. Surgeon-in-chief, Pennsylvania Railroad, for 30 years. Endowed the Rea Professorship of Anatomy, Northwestern University Medical School. Died, 1899.

RALPH N. ISHAM

Unveiling of Portrait[1]

By RALPH ISHAM, Chicago
Grandson of Ralph N. Isham

Dr. Ralph N. Isham was born in Mannheim, New York, on March 16, 1831, the first child of Dr. Nelson Isham and Delia Snell Isham. The family came of pre-Revolutionary stock, which means that all of the boy's antecedents had the instincts and motives of the pioneer and crusader. The home was early moved to the neighboring town of Little Falls, and Ralph Isham used to walk eight miles every day in order to attend the Herkimer Academy.

In early manhood Ralph Isham went to New York City to pursue the medical studies begun under his father and Dr. Terry of Hartford. He obtained his medical degree in 1854 from the medical college of Bellevue Hospital and was house physician and surgeon in the Bellevue Hospital under Dr. John T. Metcalfe. That same year because of his poor health, he was advised to take a sea voyage and sailed for England as ship's doctor on board the *Cornelius Grinnell.* In Dublin he

[1]The portrait of Dr. Ralph N. Isham was unveiled by Ralph Isham of Chicago. The biographical sketch which is herewith presented was prepared by Harriet Isham Carpenter (Mrs. George A.) of Chicago, daughter of Dr. Ralph N. Isham.

was graciously received by Dr. Wilde (father of Oscar Wilde), the leading physician, whose house was a center of social as well as medical activities. Upon his return to America Dr. Isham was advised to seek a cure for his lung trouble in the great country then opening up in the northwest. Thus, in the autumn of 1855, after travelling by steamboat and stage coach, the young doctor arrived in Chicago, soon making a host of friends and earning for himself an enviable position in the community.

In the first years of his practice in Chicago, Dr. Isham was helped and encouraged by Dr. Brainard, a brilliant man whose life was sacrificed in the cholera epidemic of 1866.

The first tracheotomy ever performed in Chicago was done by Dr. Isham in 1855. The patient was Robert Patterson, the son of the Reverend Robert W. and Julia Quigley Patterson. The stern calvinistic ideas held by Dr. Patterson, who was the leading Presbyterian minister in Chicago, were in direct opposition to any intervention in the ways of Providence, but the operation was finally performed and the boy's life saved. The story is also recalled of an ignorant Polish woman who was to have an operation performed in her home in the crowded northwest part of town. When her relatives and neighbors learned of the plans for the operation they attacked Dr. Isham and his assistants with knives and forced them to make a hasty retreat. We do not know what happened to the patient in this case of human intervention.

In 1859 Dr. Isham invited to his office a group of earnest young men whose aim was to establish an institution for standardized medical teaching. This small group of men worked together to the end of their days in behalf of the Chicago Medical College. A letter in the handwriting of Dr. N. S. Davis, the first president of the college, in which he offered Dr. Isham the Chair of Surgery with full control over didactic teaching is now in the possession of the Archibald Church Medical Library. It reads as follows:

Chicago, Ill., April 23rd, 1881,
65 Randolph st.

Prof. R. N. Isham

Dear Doctor: I called at your house this evening hoping to get an interview with you concerning the department of Surgery in the College. There is a cordial and unanimous desire on the part of your Colleagues to have a satisfactory arrangement made by which you shall not only retain a place in the Faculty but shall have a much more prominent and independent field of Surgical teaching.

I have ascertained that it would be entirely satisfactory to Prof. Andrews to have his chair made one exclusively of *Clinical Surgery,* giving him both the Monday and Saturday Clinics in Surgery and *no didactic Lecturing;* thereby giving you the whole chair of *Principles and Practice of Surgery* and the whole didactic course on Surgery throughout the College year. Your manner of didactic teaching is more popular among our students than that of almost any other member of the Faculty. And as you have a good field for *operative* practice in the County Hospital, would it not meet your favor to take, with an independent chair, the full didactic course. It need not require more than *three* lectures, namely, from 3 to 4 P. M. of Tuesday, Thursday and Friday of each week through the whole term.

Please think this over and let me know your views on Monday or Tuesday if possible and thereby oblige

Yours truly,
N. S. DAVIS.

In the University catalogue for 1881-2, Dr. Andrews is listed as Professor of Clinical Surgery and Dr. Isham as Professor of the Principles and Practice of Surgery.

During the Civil War Dr. Isham's status was that of contract surgeon and one of the organizers of the United States Sanitary Commission. His duties took him twice to the front, and on one of these occasions he travelled with a relief train to the battlefield of Pittsburg Landing, described by him as one of the bloodiest battles of the war.

In 1862 Dr. Isham was made surgeon in chief of the U. S. Marine Hospital, temporarily a military hospital, then situated on Rush Street and the Chicago River; and he continued in charge of the hospital until the late seventies. He was also consulting surgeon of the Cook County, Presbyterian, and Passavant hospitals, and surgeon with rank of major of the First Regiment of the Illinois National Guard.

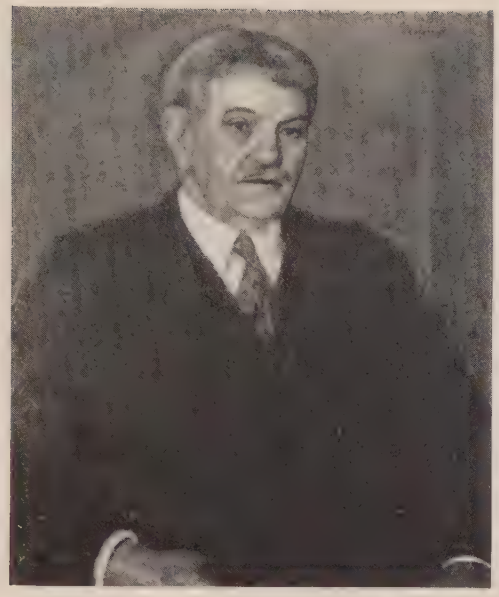
As Dr. Isham was also chief surgeon of the Chicago and Northwestern Railroad before there were any telephones or any organized nursing or medical staff, it not infrequently happened that his household would be aroused by a ring of the night bell and the announcement that an engine was waiting on the tracks to take the doctor to the scene of a railroad accident. Sometimes the journey was a long one and required many days' absence. On one such occasion he saved the life of a conductor who had been scalped by Indians out on the prairie.

In 1881 Dr. Isham was delegate from the American Medical Association to the First International Medical Congress held in London. It was at this Congress that Lister demonstrated his epoch-making discovery of the principles of antisepsis, and Dr. Isham on his return was the first in Chicago to perform an antiseptic operation.

Throughout his life Dr. Isham constantly gave of his time and strength in free hospital service, dispensary work, and teaching at the Medical College (for which he never accepted any remuneration), and success, recognition, and material blessings came as a result of his unceasing toil. The greatest source of gratification to him in his declining years was the knowledge that in those early days in Chicago he and his colleagues in founding the Chicago Medical College had "builded better than they knew."

His picturesque career came to a close on May 28, 1904.

RALPH N. ISHAM. Born at Mannheim, New York, March 16, 1831. M.D., Medical College of Bellevue Hospital, New York, 1854; LL.D., University of the City of New York; LL.D., Northwestern University. Member of the staff, City Hospital, Chicago, 1856. One of the founders, Chicago Medical College, 1859. Professor of Surgery and Anatomy, Northwestern University Medical School for many years. Surgeon, Civil War; one of the organizers, U. S. Sanitary Commission. Surgeon-in-chief, U. S. Marine Hospital, 1862. Chief Surgeon, Chicago and Northwestern Railway; Consulting Surgeon, Cook County, Presbyterian and Passavant hospitals; Surgeon, with rank of Major, First Regiment, Illinois National Guard. Delegate, International Medical Congress, London, 1881. The first in Chicago to perform tracheotomy, 1855. Died, May 28, 1904.



EMILIUS CLARK DUDLEY

Unveiling of Portrait

By KARLETON S. HACKETT, Chicago

Chicago Evening Post

I have the honor of unveiling this portrait of Dr. Emilius Clark Dudley, Professor Emeritus, who has served Northwestern University Medical School for forty-five years, a longer term than that of any other professor.

The period of his active labors covered a considerable part of the great revolution in medicine when the old foundations were swept away and had to be built anew.

He was a man for the age, of insatiable curiosity and indomitable will, grappling with problems, determined to wrest out the truth, daring to follow wherever the facts might lead, yet with the temper of mind to weigh evidence, think clearly through and hold the balance.

This likeness has been drawn with sympathetic understanding by one of those best qualified to know—his daughter Katherine. It shows a man of the old English breed as molded by New England, idealistic and chivalric in spirit, stern in action, one of quick decision and heavy, downright stroke, apt to be short with those of flabby fibre who hesitate and trim, yet when the work is done expanding with the genial glow of good fellowship and cleaving to his spiritual kin with the primal instinct of the clan.

In short, compounded of the stuff which has been the energizing force in the upbuilding of this nation.

EMILIUS CLARK DUDLEY. Born in Westfield, Mass., May 29, 1850. A.B., Dartmouth College, 1873; M.D., Long Island College Hospital, 1875; A.M., Iowa College, 1892; LL.D., Grinnell College, 1917. Member, Board of Education, Chicago, 1901–06. Visiting Professor, Huna-Yale Medical School, Shanghai, China; Peking Union Medical College, Peking, China; Medical School of the Christian Union University, Tsinan Fu, China; University of the Philippines, 1922. Professor of Gynecology, 1882–1920; Professor Emeritus of Gynecology, since 1920; Northwestern University Medical School. Consulting Gynecologist, St. Luke's Hospital. President, American Gynecological Association, 1904. President, Chicago Gynecological Society. Major, M. O. R. C., 1917. President, Board of Commissioners, State of Illinois, 1920–21. Author: General Consideration of Gynecological Surgery (Mann's System of Gynecology), 1887; Displacements of the Uterus (Pepper's System of Medicine), 1890; Diseases of Women: a Treatise on the Principles and Practice of Gynecology, 1898; Principles and Practice of Gynecology, 1908; Gynecology (Practical Medicine Series; with von Bachellé), 1911; the Medicine Man: Being the Memoirs of Fifty Years of Medical Progress, 1927, and numerous articles on gynecology.

FRANK BILLINGS

Unveiling of Portrait

By ROBERT BRUCE PREBLE, M.A., M.D., Chicago

Professor of Medicine, Northwestern University Medical School

Were any one to go through a list of the graduates of this school with the idea of selecting the one who has been must useful in the most varied ways to medicine and to the world in general, it is certain that he would pick out the name of the man whose picture we are about to unveil, Dr. Frank Billings.

The time proper for an occasion such as this is too brief to permit a review of all of his diverse activities and contributions, all most helpful, but there is great inspiration in reviewing even a few of them.

Immediately after his graduation he became an interne in the Cook County Hospital, where—then as now—valuable post-graduate opportunities are offered and where brilliant, kindly, thoughtful services are rendered to the poor of the County. It is probable that he there realized the need for further study and as soon after as possible, he went to Europe, where he eagerly acquired a knowledge of the best established methods. In particular did he acquire skill in the methods of physical diagnosis, then little known and less practiced in Chicago. On his return here, this new knowledge and its skillful use, together with his other outstanding qualifications,

brought him prompt recognition as a physician of extraordinary power and started him well in what one might call the primary field of the physician, namely the care of the sick. He rendered great service in clinic, hospital and in private practice and rapidly became the leading consultant throughout the West. He combines in a remarkable degree knowledge and judgment with a stimulating personality, radiating cheer, hopefulness and encouragement, often more important to the patient than any pill or powder.

He has always been one of those rare persons in medicine who can maintain a position of intellectual aloofness in regard to questions of diagnosis, so that his judgment is not swayed by sentimental considerations; but once the question of diagnosis is settled, he becomes the stimulating, sympathetic, helpful friend. Unfortunately, this form of dual personality is rare among doctors.

From the beginning of his career, he has filled another, less immediate but more far reaching, duty of the doctor. He has been a great teacher. He taught physical diagnosis at a time when the teaching of this important branch was in its infancy and later taught clinical medicine for many years in this college and later for years in Rush Medical College. It is to be noted that he was never a mere imparter of facts. He was a great inspiration to all of his students and colleagues and it is here that Dr. Billings' usefulness has been greatest, for if one were to add to his personal contributions to medicine, the hundreds made by his students under the stimulation of his inspiring example, the list would be great indeed. Not only has he influenced large bodies of men directly, but because of his interest in the advancement and improvement of medical education, he has indirectly influenced thousands of students with whom he has had no direct personal contact. No idea leading to the improvement of medical education has lacked his cordial co-operation, and many of these ideas have arisen in his own brain.

Dr. Billings has always taken a leading part in medical organization, local, state and national, and has taken a great part in the re-organization of the American Medical Association which has made this one of the most useful and powerful organizations of its sort in the world. He has served this organization as its president; indeed, I know of no honor which the profession has not gladly and justly paid him.

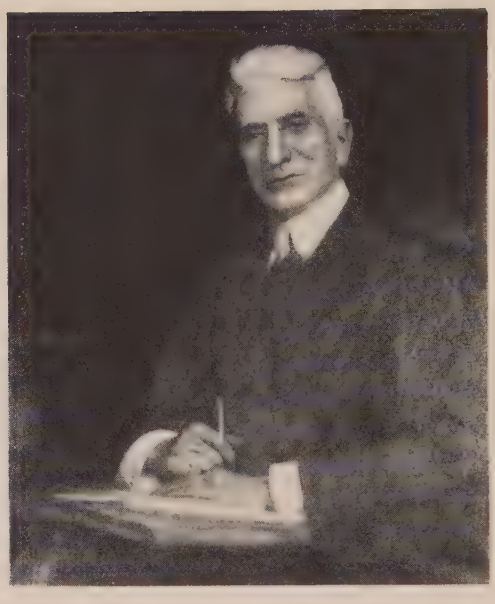
In addition to these and many other medical activities, Dr. Billings has been an important factor in many civic movements; in fact, no important movement of this sort could be considered without his aid and advice.

During the World War, in spite of the fact that he was beyond the established age limit, he took a most active and useful part in the service of the Medical Corps, both in this country and in Europe. He was given the rank of Brigadier General, was awarded the Distinguished Service Medal and has recently been made an officer of the French Legion of Honor.

This brief recital of the accomplishments which have won for him the respect and admiration of his associates is a very incomplete one and yet, how few men there are about whom as much could be said. However, if one were to say only these things of him strangers might formulate a very incomplete idea of this great man; they might imagine him as being a mere thinking machine, while in reality he has many other qualities which have endeared him to all who have been fortunate enough to know him. His courage in the support of whatever he thinks right, his helpfulness to all

those in trouble, his fairness and justice, have made him a trusted arbiter, and his sense of humor and his joy in the pleasant things of life have made him a desirable companion. Kindly, charitable, lovable and loved, he will continue always to be a joy and inspiration to his friends and those who will come after.

FRANK BILLINGS. Born in Highland, Iowa County, Wisconsin, April 2, 1854. M.D., Northwestern University Medical School, 1881; M.Sc., Northwestern University, 1890; D.Sc., Harvard University, 1915; LL.D., University of Cincinnati, 1924; Sc.D., University of Wisconsin, 1924. Studied in Vienna, London, Paris, 1885–86. Demonstrator of Anatomy, 1882–86; Professor of Physical Diagnosis, 1885–90; Professor of Medicine, 1890–98, Northwestern University Medical School. Professor of Medicine, 1898–1924; Dean of Faculty since 1900, Rush Medical College. Professor of Medicine, 1905–24; Professor Emeritus of Medicine, since 1924, University of Chicago. Attending Physician, Cook County Hospital, 1887–1900; Mercy Hospital, 1888–98; Presbyterian Hospital, 1898–1920; Consulting Physician, Presbyterian Hospital since 1920. Research work on focal infection, 1900–15. First Lieutenant, Medical Reserve Corps, 1907–17; Major, 1917; active military service (office of Provost Marshall General and office of Surgeon General), 1918; Lieutenant Colonel, May, 1918; Colonel, June, 1919; A. E. F. (France and England), August–October, 1918; discharged, June 29, 1919; Brigadier General, M. O. R. C., 1922. Chairman, American Red Cross Mission to Russia, 1917. Author: Focal Infection; Change in the Spinal Cord in Pernicious Anæmia; Chronic Infections; Arthritis; Modern Medicine and Commerce; and more than 100 articles and addresses. Editor, Billings-Forcheimer Therapeusis. President, Chicago Medical Society, 1890; President since organization in 1902, John McCormick Institute for Infectious Diseases; President, American Medical Association, 1902–04; President, Association of American Physicians, 1906; President, Illinois State Board of Charities, 1906–12; President, National Association for the Study and Prevention of Tuberculosis, 1907; President, Illinois State Medical Society, 1908; Trustee since 1909, President since 1912, Otho. S. A. Sprague Memorial Research Institute; President, Congress of Physicians and Surgeons, 1922.



FRANKLIN H. MARTIN

Unveiling of Portrait

By ALLEN B. KANAVEL, Ph.B., Sc.D., M.D., Chicago

Professor of Surgery, Northwestern University Medical School

Among the most important attributes of the human mind are imagination and executive ability. Dr. Franklin H. Martin has demonstrated to the highest degree his possession of both of these qualities.

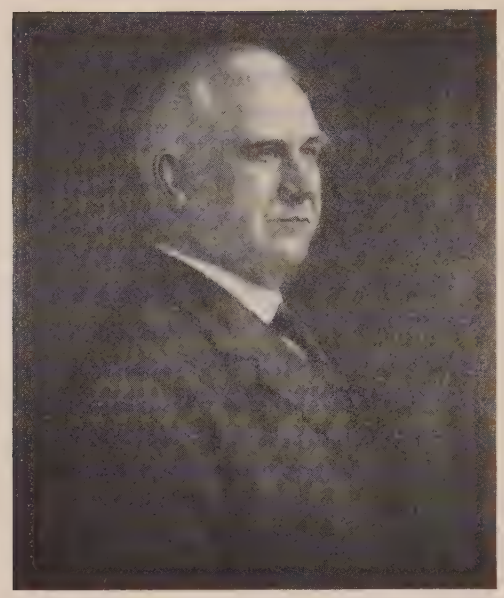
The conception and organization of the American College of Surgeons, though probably the most conspicuous of his achievements, is but one of several, each having for its end service to medicine and the perpetuation of its ideals. As a surgeon he has contributed much to the advancement of his specialty—gynecology—international recognition of which has been accorded him by an honorary degree from the Queen's University of Belfast, and honorary fellowships in various societies in Europe, South America, and his own country. During the World War he served his country with distinction and in appreciation of his services was decorated by both England and the United States. As a graduate of Northwestern and a trustee of his Alma Mater, he has been loyal and devoted; as a fellowman he has endeared himself to us all by his generous friendship and unselfish service.

In recognition of his service to his University, his profession, and to mankind,

I am privileged to unveil this portrait to be kept as a perpetual reminder to the students that Northwestern takes pride in the achievements of its graduates; and I herewith hand to you, Dean Cutter, a record of Dr. Martin's publications, offices of honor, distinctions, and achievements to be preserved in the records of the Medical School.

DEAN CUTTER: This record of the distinguished career of Dr. Franklin H. Martin, as prepared by Dr. Kanavel, will be preserved in the archives of the School of Medicine.

FRANKLIN H. MARTIN. Born in Ixonia, Wisconsin, July 13, 1857. M.D., Northwestern University Medical School, 1880. Member of the Staff, South Side Dispensary, Chicago, 1883–88. Professor of Gynecology, Policlinic of Chicago, 1886–88. Organizer, with Dr. W. F. Coleman, Post-Graduate Medical School of Chicago, 1888. Gynecologist, Woman's Hospital, 1887. Organizer, Charity Hospital, 1887. Consulting Gynecologist, St. Luke's Hospital. Organizer, 1905; Editor-in-chief since 1905, Surgery, Gynecology, and Obstetrics. Organizer, 1913; Editor-in-chief since 1913, International Abstract of Surgery. Organizer, 1910; Director-General since 1910, Clinical Congress of Surgeons of North America (now the Clinical Congress of the American College of Surgeons). Organizer, 1913, Director-General since 1913, American College of Surgeons. Member of Advisory Commission, Council of National Defense (appointed by President Woodrow Wilson), 1916–21. Chairman, General Medical Board, Council of National Defense, 1917–19; Chairman, Executive Committee of General Medical Board, 1917–19. Colonel Medical Corps, U. S. A., 1917–19; Colonel, A. E. F., 1918; discharged, July 15, 1919. Associate Editor, American Journal of Obstetrics and Gynecology, Member, Editorial Board, Chicago Medical Recorder. President, International Association of Gynecologists and Obstetricians, 1919. Trustee, Northwestern University since 1921. President, Gorgas Memorial Institute of Tropical and Preventive Medicine since 1925. Honorary Advisor, U. S. Army Industrial College. President, Chicago Gynecological Society, 1895. President, American Gynecological Society, 1919. Charter Member, Chicago Medical Club; Charter Member, Chicago Council on Foreign Relations. Author: Treatment of Fibroid Tumors of the Uterus, 1897; Treatise on Gynecology, 1903; South America from a Surgeon's Point of View, 1923; Monograph, Australia and New Zealand; and other books and monographs on gynecology. C.M.G. (Companion of the Order of St. Michael and St. George), decorated by King George V., through the Prince of Wales, in Washington, D. C., November 13, 1919, in recognition of services rendered to the British Empire during the Great War. D.S.M. (Distinguished Service Medal), U.S.A., in recognition of services rendered during the Great War. LL.D. (Hon.), Queen's University, Belfast, Ireland. D.P.H. (Hon.), Detroit College of Medicine and Surgery.



JOHN HARPER LONG

Unveiling of Portrait

By FREDERICK ROBERT ZEIT, M.D., Chicago

Professor of Pathology
Northwestern University Medical School

Professor Long's activity at Northwestern University and the Medical School is closely connected with the historic advance in the sciences by the laboratory method of teaching. Following his election to the Professorship of Chemistry in 1881, he devoted all of his time to teaching and research, and was a staunch advocate of the laboratory method of teaching in all the departments of the Medical School.

The first and only systematic laboratory course given in the Medical School was his course in chemistry and it was principally through his untiring efforts and influence that the departments of anatomy, physiology, bacteriology, pathology and pharmacology were reorganized and gradually enabled to develop laboratory courses with professors in charge who could devote their whole time to teaching and research.

He was ever ready to lend his energetic support to the building up of the laboratory branches, guided at all times only by his absolute loyalty to the best interests of Northwestern University Medical School and the advancement of medical education in general. In the medical, chemical and sanitary councils of the nation he was distin-

guished and respected for his intimate knowledge and sound judgment. He was without fear or favor, his opinion was based always upon the guiding principles of his life—absolute fairness and honesty. He was one of the few who could maintain straight thinking in the midst of theoretic turmoil and discussion.

A strong and upright personality, of Spartan simplicity, an untiring man of science to whom creative work was a pleasure; stern, rigid and keen in his recognition of merit or sham, a virile and courageous champion of everything that was true and good and beautiful; a merciless adversary of all frauds and pretenses. Absolute loyalty to the best interests of the University was the keynote of all his actions at the Medical School. Summer and winter found him toiling in his chemical laboratory. He was the first to arrive and the last to leave it. Enforced vacations bored and annoyed him. He was restless to return to the sanctum of his chemical laboratory.

His whole personality, his emotions and manner of expression, betrayed the nobility of the thoughts and the golden heart of this good and distinguished man who was to many of us friend, teacher and father.

So we dedicate this lifelike portrait of Professor John Harper Long to Northwestern University Medical School in memory of our great fortune to have called this manly man and great scholar our teacher and friend.

I will now ask Master John Harper Miller, the grandson of Professor John Harper Long, to unveil the portrait of his grandfather.

JOHN HARPER LONG. Born near Steubenville, Ohio, December, 1856. B.S., University of Kansas, 1877. Post-graduate work, Tübingen, Würzburg and Breslau, 1877-80. Sc.D., Tübingen, 1879. Professor of Chemistry, 1881-1918; Dean, School of Pharmacy, 1913-1917, Northwestern University Medical School. Chemist, Illinois State Board of Health, 1885-1905. Member, Referee Board of Consulting Scientific Experts, U.S. Department of Agriculture; Revision Committee, U.S. Pharmacopœia; Council on Pharmacy and Chemistry, American Medical Association. President, American Chemical Society, 1903-04. Author: Elements of General Chemistry, 1898; Textbook of Analytical Chemistry, 1898; Textbook of Urine Analysis, 1900; Laboratory Manual of Physiological Chemistry, 1894; The Optical Rotating Power of Organic Substances (from German), 1902; Textbook of Physiological Chemistry, 1905. Died, June 14, 1918.

OTTO LEOPOLD SCHMIDT

Unveiling of Portrait

By LESSING ROSENTHAL, Chicago

It is indeed a privilege to be permitted to present to this hall of medical fame the portrait of another physician of eminent standing both in his profession and in citizenship.

It was on March 21, 1863, while the country was in the throes of civil war, that Otto Leopold Schmidt was born in Chicago, the son of Ernst Schmidt, one of that band of liberty-loving Germans who came to our shores in the second quarter of the last century. The father served the North with distinction during the Civil War. He attained great eminence in Chicago as a physician, was a man of fine physique, virile character and literary attainments. He was much admired and respected in this community. He died in 1900, greatly mourned. His wife was a person of strong character and homely virtues, a quiet, unassuming, well-read woman who consecrated her life to her husband and the rearing of their four splendid sons.

Otto Schmidt attended the public schools of Chicago—first the Jones, then the Haven School. From 1877 to 1880 he was a pupil at the old Central High School. Then he entered the Chicago Medical College, now the Medical Department of the Northwestern University, and in 1883 received his degree of Doctor of Medicine.

Medical science had not risen to the high plane upon which it stands today, but in those early years strong men and busy practitioners, endowed with much common sense, industrious, fine examples for the younger men, were active in the teaching of medicine. Dr. Nathan S. Davis, one of the founders of the American Medical Association, was then Dean of the Chicago Medical College. In the department of surgery, Edmund Andrews and Ralph N. Isham were the professors. Dr. Robert L. Rea, a teacher whose superior ability has just been eloquently portrayed by Dr. Church, was anatomist; Dr. Edward O. F. Roller, obstetrician; Dr. John H. Hollister, pathologist; Dr. James S. Jewell, neurologist; Dr. Henry Gradle, physiologist; and Dr. William E. Quine had the chair of materia medica; all names that stood high on the medical rolls of Chicago a half century ago. I have often heard it said—and of this we have again been reminded today—that the influence of these men on their students can not be measured merely by the subjects they taught.

After receiving the degree of Doctor of Medicine in 1883, Dr. Schmidt spent six months as interne in the Cook County Infirmary, and then eighteen months at the Alexian Brothers Hospital. The following two years, 1885 to 1887, were spent abroad. It was in Würzburg and Vienna that Dr. Schmidt assiduously continued his studies in internal medicine, and when in 1887 he returned to Chicago he was excellently qualified for practice by inheritance, by study, by energy, by resolution, and by natural aptitude. He at once was put on the staff of the Alexian Brothers Hospital, and as physician and consultant has been connected with that institution ever since. He was also for many years consulting physician at the Michael Reese Hospital.

From 1889 to 1892 Dr. Schmidt was instructor of medicine in the Medical Department of Northwestern University, but the exacting demands of his private practice were such that he felt constrained to give up teaching.

His broad and catholic tastes, especially his great interest in historical matters, early exhibited themselves. Biography and history always had a great fascination for Dr. Schmidt. In 1911 he became a member of the Illinois State Historical Library, and has ever since been actively connected with it. From 1923 on, he has been chairman of that body. Since 1914 he has been president of the Illinois State Historical Society. He has been a member of the Board of Trustees of the Chicago Historical Society since 1899. He was elected vice-president of the Society in 1914 and continued in that office until 1923 when he was elected president. He still occupies that position. For twelve years he has been president of the German-American Historical Society. His election in 1926 as president of the Mississippi Valley Historical Association made him at one time the head of four important historical societies.

We all know the great extent of his labor—a true labor of love—on behalf of these associations, his devotion to the work, his intelligence and good judgment. We know, too, of the demands that were made upon him as chairman of the Illinois Centennial Commission during the years 1916 to 1920. We realize the genuine fruits of his chairmanship which resulted not merely in the appropriate celebration in 1918 of the hundredth anniversary of the admission of our State into the Union, but in the production of six important volumes of its history, written by learned authorities. These will constitute a lasting and reliable record of the story of Illinois and a monument of its achievements.

It was because of his creditable service to humanity that Northwestern University

conferred upon Dr. Schmidt the title of *Doctor Literarum Humaniorum* in June, 1922, a distinction he richly deserved.

When Mayor Dever cast about to find a man who might understand the needs of the Board of Education, who was endowed with excellent sense, who would be faithful to the interests of our children, who would be courageous and independent, he wisely selected Dr. Schmidt. Over the protests and against the earnest advice of his friends, who feared that Dr. Schmidt, with all of his other tasks, was undertaking more than his health would permit, Dr. Schmidt accepted the appointment, not because he coveted the honor, but out of a sheer sense of civic duty.

As a physician Dr. Schmidt has advanced to the front rank in his profession. He is gifted with an innate sense and natural talent for the practice of medicine, and this, together with his great industry and self-sacrifice, was certain to bring him success. The pecuniary rewards incident to a large and important practice have never had the slightest attraction for him. He has always been more interested in the service of humanity, and the poorest and humblest citizen has ever appealed to him as strongly as the wealthiest and most powerful. Thousands who have been his patients could testify to his deep sympathy, to his interest in them as human beings, and to his sacrifice of valuable time to their care, and these traits have endeared Dr. Schmidt to their hearts. But he has about him that other great attribute not given to all men of parts—personality. His entrance into the sickroom inspires confidence; and his strong personality, coupled with his beautiful sympathy, his gentle manner, his true interest and practical sense, evoke a feeling of comfort and hope.

But Dr. Schmidt has recognized that there are other worlds besides the world of medicine. Never in his activities has he been restricted by the confines of his profession. He has traversed into other fields and thus has gained that breadth of outlook so important to the educated person. He has never been hampered by that narrowness which so frequently impairs the usefulness of the purely professional man—the man who has no interest beyond his profession. Music, art and literature have always made a strong appeal to him. They have widened his horizon and deepened his knowledge, and his continuous educational, public and civic activities attest his conviction that he who fails to serve his fellow citizens, his community and his state falls short of his obligations to humanity.

Dr. Schmidt's likeness in oil and color, which we are now unveiling and which we sincerely hope will long adorn the walls of this attractive room, reveals in a measure his penetrating intelligence and kindly bearing. Perhaps, too, it portrays his sterling character, his refinement and his culture. But it hardly shows what may possibly be regarded as his finest characteristic—his indifference to the plaudits of the multitude. In this attitude well may he appropriate to himself the words of Sydenham:

> My fame is in the hands of others. I have weighed in a nice and scrupulous balance, whether it be better to serve men, or to be praised by them, and I prefer the former. It does more to tranquillize the mind; whereas fame, the breath of popular applause, is but a bubble, a feather, and a dream.

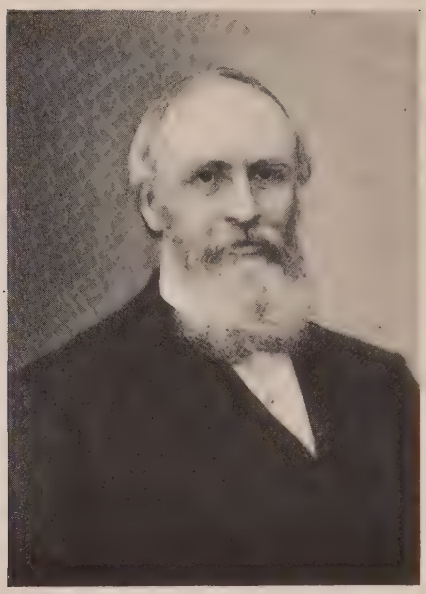
OTTO L. SCHMIDT. Born in Chicago, Illinois, March 21, 1863. M.D., Chicago Medical College, 1883. Post-graduate work, University of Würzburg, University of Vienna. Consulting Physician, Alexian Brothers Hospital; Consulting Physician, Grant Hospital. Chairman, Illinois Centennial Committee, 1916–20. President, Illinois State Historical Society, since 1914. President, Chicago Historical Society, since 1923. President, Illinois State Historical Library, since 1923.

ADDITIONS

TO THE COLLECTION

OF PORTRAITS

Subsequent to the ceremony of unveiling, portraits of Edmund Andrews, Nicholas Senn, John Ridlon, Edmund Janes Doering, Frank Seward Johnson, Nathan Smith Davis, II, Thomas James Watkins, Charles Horace Mayo and William James Mayo, and Isaac Arthur Abt, as well as a bust of Hosmer Allen Johnson, were added to the collection in the Archibald Church Medical Library. In the following pages are given brief biographical sketches of these distinguished alumni and members of the faculty of Northwestern University Medical School.



EDMUND ANDREWS

Born in Putney, Vermont, April 22, 1824; died, January 22, 1904. His father, Rev. Jonathan Andrews, was the Congregational minister at Putney; his grandfather, Jonathan Andrews, was a minute man in the Revolutionary War. Edmund Andrews, B.A., 1849; M.D., M.A., 1852, University of Michigan. Demonstrator of Anatomy, University of Michigan, 1852-55. Demonstrator of Anatomy, Rush Medical School, 1855-56. One of the founders of the Medical Department of Lind University (later Northwestern University Medical School), 1859. Professor of Surgery, Northwestern University Medical School, 1859-1904. Chief Surgeon, Mercy Hospital, for almost 50 years. Surgeon, Camp Douglas, during the Civil War. Major and Surgeon, First Illinois Light Artillery, 1862; served with this organization in campaigns in Tennessee and Mississippi. Editor: Peninsular Journal of Medicine and Allied Sciences, 1852-55. Author: Several medical books; The Early Glacial History of North America. He compiled and published statistics on 98,815 cases in which ether anæsthesia was employed, and 117,078 cases in which chloroform anæsthesia was employed, and showed the relative risk in the use of these agents. He also collected and published extensive data tending to show the failure of licensed prostitution. Designer of valuable surgical instruments and devices. He was said to have been the first to employ antiseptic surgery in Chicago. Founder and President for several years of the Chicago Academy of Sciences. One of the founders of the Michigan State Medical Society. President, Chicago Medical Society, 1879-80. For 50 years, a member of the Second Presbyterian Church of Chicago.

HOSMER ALLEN JOHNSON

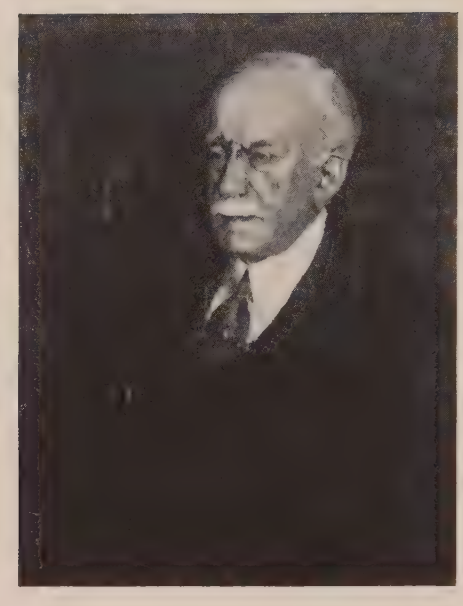
Born at Wales, near Buffalo, New York, October 22, 1822. A.B., 1849; A.M., LL.D., University of Michigan. Studied medicine in Chicago with Dr. William B. Herrick. M.D., Rush Medical College, 1852. The first interne at Mercy Hospital. A member of the faculty, Rush Medical School, 1853-1858, serving successively as lecturer on Physiology, Professor of Materia Medica, Therapeutics and Medical Jurisprudence and General Pathology. One of the founders, 1859, and first President of the faculty, Chicago Medical College (later Northwestern University Medical School), holding at different times the chairs of Materia Medica and Therapeutics, Physiology and Histology, General Pathology and Pathological Anatomy, Clinical Medicine and Principles and Practice of Medicine and Clinical Medicine; Professor Emeritus, 1882-1891. Commissioned Major by Governor Yates of Illinois; President of the Board of Examining Surgeons during the Civil War. After the great Chicago fire, he was one of the managers of the Relief and Aid Society which distributed millions of dollars among the sufferers. An early member of the American Medical Association, Illinois State Medical Society and Chicago Medical Society. Secretary, 1852-58; President, 1858; Illinois State Medical Society. Secretary, American Medical Association, 1860. Delegate of the American Medical Association to the Medical and Scientific Associations of Europe, 1865. Organizer and first officer, Grand Commandery of Knights Templar of Illinois, 1856. Officer of Supreme Council at Boston, 1868. Died, February 26, 1891.

NICHOLAS SENN

Born in the canton of St. Gall, Switzerland, October 31, 1844. Moved to Washington County, Wisconsin, 1852. M.D., Chicago Medical College, 1868. Private practice, Ashford, Wisconsin, 1870. Attending Physician, Milwaukee Hospital, 1875. Graduate, *cum laude,* University of Munich, 1878. Professor of Surgery, College of Physicians and Surgeons, Chicago, 1882. Professor of Principles of Surgery and Surgical Pathology, 1888; Professor of Surgery and Clinical Surgery, 1891, Rush Medical College. Professor of Surgery, Chicago Policlinic. Professor of Surgery and Military Surgery, University of Chicago. Surgeon-in-chief, St. Joseph's and Presbyterian hospitals. Surgeon-General, National Guard of Wisconsin, 1882. Founder and first President, Association of Military Surgeons, National Guard, 1892. Surgeon-General, National Guard of Illinois, 1893. Active service in the Spanish American War; present at the battle of El Caney; performed distinguished service in the Cuban campaign. President, Chicago Medical Society, 1894; President, American Medical Association, 1897. Author: Surgery of the Pancreas, 1885; Experimental Surgery; Intestinal Surgery; Surgical Bacteriology; Principles of Surgery; Pathology and Surgical Treatment of Tumors; Around the World via Siberia; Around the World via India; Our Recreation Parks; Tahiti, the Island Paradise; In the Heart of the Arctics; Travels in Africa; Travels in South America. Presented his medical library, representing an expenditure of $50,000, to the Newberry Library (later transferred to the John Crerar Library). Donated $50,000 toward a clinical building (now known as the Senn Memorial Building), Rush Medical College. Died, January 12, 1908.

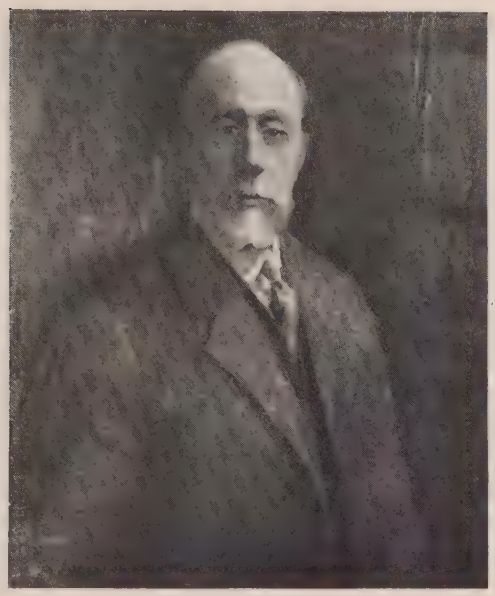
JOHN RIDLON

Born in Clarendon, Vermont, November 24, 1852. A.B., 1875; A.M., 1878; University of Chicago; M.D., College of Physicians and Surgeons, Columbia, 1878; A.M., Tufts College, 1899. Assistant Orthopædic Surgeon and Attending Orthopædic Surgeon, St. Luke's Hospital, New York for 8 years; Assistant Surgeon, New York Orthopædic Dispensary and Hospital for 7 years; Instructor, Orthopædic Surgery, University Medical School, New York, for 5 years; Surgeon, Bellevue Hospital, New York, for 2 years; Assistant Surgeon, Vanderbilt Clinic, New York, for 2 years; Consulting Orthopædic Surgeon, St. Luke's, Michael Reese, Wesley Memorial, Mercy, and Presbyterian hospitals, Chicago; Home for Destitute Crippled Children; Home for Disabled Children; Home for Convalescent Children, Chicago; Home for the Friendless, Evanston, Illinois; and Newport (Rhode Island) Hospital. Professor of Orthopædic Surgery, Northwestern University Medical School, 1892-1908; Chicago Post-Graduate School, 1892-93; Northwestern Woman's Medical School, 1898-1902; Rush Medical College, 1909-12. Devised operation for reduction of congenital dislocation of the hip. President for 1 year, Secretary for 19 years, American Orthopædic Association. Major, M.C., U.S.A., 1917-19; Lieutenant-Colonel, M.O.R.C.; Surgeon, U.S.P.H.S., Veterans' Hospital, Chicago, for 5 years. Author: Over 80 articles, chiefly on orthopædic surgery, including the following: Congenital Dislocation of the Hip, 1920; Lessons from My Experience with Congenital Dislocation of the Hips, 1921; Final Results of Fracture of the Neck of the Femur without Treatment or with Worse than no Treatment, 1921.



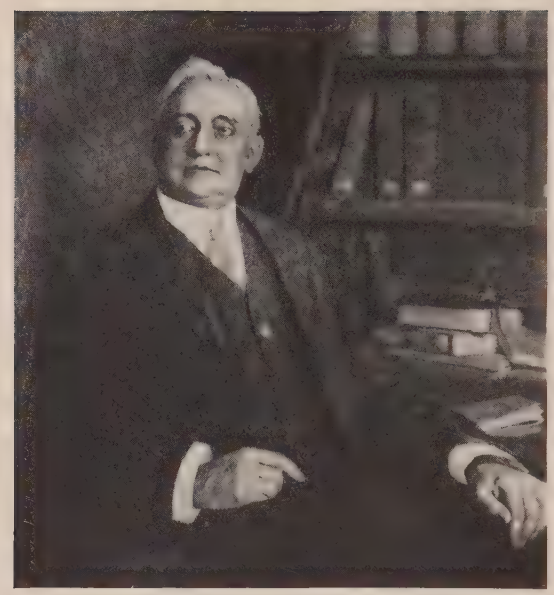
EDMUND JANES DOERING

Born in New York, November 7, 1854. M.D., 1874; M.Sc., 1916. Northwestern University Medical School. Post-graduate work, universities of Berlin and Vienna, 1875. Consulting Physician, Chicago Lying-In Hospital; Consulting Physician, Michael Reese Hospital. Editor, Chicago Medical Recorder, since 1910. President, Chicago Medical Society, 1886-87; President, Chicago Gynecological Society; President, Medico-Legal Society; Governor, Institute of Medicine of Chicago. First Lieutenant, M.R.C., U.S.A., 1911; Major, 1917; Lieutenant-Colonel, M.C., 1918; Colonel, O.R.C., 1922. Senior Surgeon, U.S. Public Health Service, 1919; Late Surgeon, U.S. Marine Hospital Service; President, U.S. Examining Board, M.R.C., 1918; District Medical Officer for Illinois, Michigan, and Wisconsin; Federal Board for Vocational Education, 1919; Chief Consultant, U.S. Veterans' Bureau, Chicago, 1919-26. President, Illinois Division, M.R.C., U.S.A.; Governor, National Reserve Officers' Association, 1922-23 and of the Military Order of the World War. Author: Medical Education in the United States; Overcrowding of the Medical Profession; Serum Treatment of Diphtheria; Hydatiform Pregnancy; and many articles reprinted from addresses on subjects connected with the Medical Corps of the United States Army, duties of nurses during the war, etc. A member of the American Medical Association, Illinois Medical Society, Chicago Medical Society, Chicago Gynecological Society, Chicago Medico-Legal Society, Institute of Medicine of Chicago, and a Fellow of the American College of Surgeons.



FRANK SEWARD JOHNSON

Born in Chicago, Illinois, April 18, 1856, the son of Dr. Hosmer Allen Johnson and Margaret (Seward) Johnson. Studied in Switzerland and Germany, 1868-69. A.B., 1878; M.A., M.D., 1881, Northwestern University Medical School. Post-graduate study at the University of Vienna. Resident physician at Cook County Hospital, 1882. Associated in practice with his father until the latter's death in 1891. Demonstrator of Histology, 1883; Professor of Histology, 1884; Professor of General Pathology and Pathological Anatomy, 1886; Professor of Medicine and Clinical Medicine, 1899; Dean of the Medical School, 1898; Emeritus Dean and Professor of Medicine, 1910, Northwestern University Medical School. Attending Physician, Mercy, Michael Reese, and St. Luke's hospitals. Consulting Physician, Michael Reese, Mercy, Woman's, and Provident hospitals. A member of the American Microscopical Society, American Medical Association, American Climatological Association, National Association for the Study and Prevention of Tuberculosis, Chicago Academy of Sciences, Chicago Medical Society, Chicago Medico-Legal Society, and Chicago Pathological Society. First Lieutenant, M.R.C., 1911. Director of John Crerar Library. Died in Pasadena, California, April 23, 1922.



NATHAN SMITH DAVIS, II.

Born in Chicago, Illinois, September 5, 1858. A.B., 1880; A.M., 1883, Northwestern University. M.D., 1883, Chicago Medical College. Post-graduate work, universities of Heidelberg and Vienna. Assistant Professor of Pathology; Professor of the Principles and Practice of Medicine, 1886; Professor of Clinical Medicine, 1887; Secretary and then Dean of the Faculty, for many years, Northwestern University Medical School. Physician, Mercy, Wesley, and St. Luke's hospitals. Vice-President, for many years, U.S. Pharmacopœia Convention. Councilor, section of Pathology, Ninth International Medical Congress. One of the organizers, Society Medical History of Chicago, 1909. Trustee, for many years, Northwestern University, Wesley Hospital, and the Y.M.C.A. Author: A Treatise of General Practice; Consumption—How to Live with It; Diet in Health and Disease; Physiological Action of Typhoid Fever Poison, 1889; The Necessity of Scientific Training for Students of Medicine (the introductory address at the opening of Northwestern University Medical School, 1889); Uræmia, 1892; Diseases of the Lungs, Heart, and Kidneys, 1892; Remarks on the Treatment of Diabetes Mellitus, 1893; Pulmonary Hypertrophic Osteoarthropathy, 1895; Cases of Valvular Disease of the Heart, 1895; Animal Extracts, 1896; Prophylaxis of Tuberculosis, 1897; Address on Antivivisection Legislation, 1898; Dietetic Treatment of Diabetes, 1900; Diagnosis and Treatment of Round Ulcer of the Stomach, 1901; Dietotherapy and Food in Health, 1901; Treatment of Typhoid Fever, 1902; Exercise as a Mode of Treatment for Heart Disease, 1903. Died in Pasadena, California, December 21, 1920.

THOMAS JAMES WATKINS

Born in Utica, New York, July 6, 1863. Studied for 3 years at the University of Michigan. M.D., Bellevue Hospital Medical College, New York, 1886. Interne at the Utica (N. Y.) City Hospital, St. Peter's Hospital of Brooklyn, and the Woman's Hospital of the State of New York. Moved to Chicago in 1889. Assistant Gynecologist, 1890-96; Assistant Professor of Gynecology, 1896; Clinical Professor, 1900; Professor of Gynecology, 1916-25; Northwestern University Medical School. Attending Gynecologist, St. Luke's Hospital, 1894-1925; Wesley Hospital, 1896-1914; Mercy Hospital, 1900-09. First Lieutenant, M.R.C., U.S.A., 1911. Vice-President, 1914; President, 1915, American Gynecological Society. President, Chicago Gynecological Society. A founder of the American College of Surgeons. A founder and for many years a member of the editorial board, Surgery, Gynecology, and Obstetrics. Fellow of the American College of Surgeons. Originator of the procedure called the Watkins' operation for cystocele and uterine prolapse. Author: Vaginal Section and Drainage for Pelvic Abscess; Technique of Abdominal Salpingo-Oöphorectomy without Pedicle 1896; Drainage in Abdominal Section for Pelvic Disease, 1896; Treatment of Endometritis, 1897; Gonorrhœa in Women, 1898; Tampons and Pessaries in the Treatment of Displacements of the Uterus, 1899; Gynecologic Diseases. 1899. Died April 1, 1925.

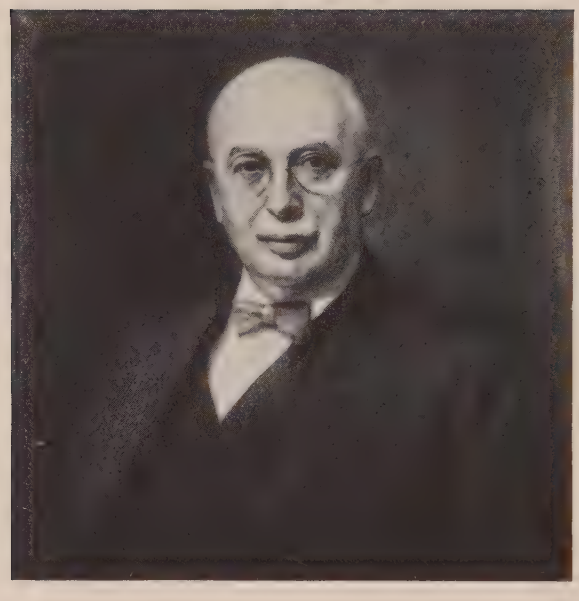
William James Mayo and Charles Horace Mayo

WILLIAM JAMES MAYO

Born in Le Sueur, Minnesota, June 29, 1861. M.D., 1883; A.M., 1899; Sc.D., 1908, University of Michigan. F.R.C.S. (Eng.); F.R.C.S. (Edin.), 1905; LL.D., University of Toronto, 1906; LL.D., University of Maryland, 1907; D.Sc., Columbia University, 1910; LL.D., University of Pennsylvania, 1912; Sc.D., Harvard University; LL.D., University of Pittsburgh, D.Sc., 1923; LL.D., McGill University. D.Sc., University of Leeds, England, 1923; M.D., University of Dublin, and Trinity College, 1923. Surgeon, St. Mary's Hospital, Rochester, Minnesota, 1889. Surgeon and Associate Chief of Staff, Mayo Clinic. Regent, University of Minnesota, since 1907. With his brother, Dr. Charles H. Mayo, established the Mayo Foundation for Medical Education and Research, in affiliation with the University of Minnesota, 1915. First Lieutenant, M.R.C., 1913; Major, 1917; Colonel and Chief Consultant, alternating with Colonel Charles H. Mayo, for all surgical services, 1917-19; Colonel, M.R.C., 1920; Brigadier-General M.O.R.C., U.S.A., 1921. President, Minnesota State Medical Society, 1895-96; President, American Medical Association, 1905-06; President, Society of Clinical Surgery, 1911-13; President, American Surgical Association, 1913-14; President, American College of Surgeons, 1917-19; President, Congress of American Physicians and Surgeons, 1925. Awarded: Gold Medal, National Institute of Social Sciences; Distinguished Service Medal, U.S.A., 1919; Henry Jacob Bigelow Gold Medal of the Boston Surgical Society. Author: Over 300 articles on scientific subjects, chiefly related to surgery.

CHARLES HORACE MAYO

BORN in Rochester, Minnesota, July 19, 1865. M.D., 1888, Northwestern University Medical School, M.A., 1904; LL.D., 1921; Sc.D., 1929, Northwestern University. LL.D., University of Maryland, 1909; LL.D., Kenyon College, 1916; D.Sc., Princeton University, 1917; D.Sc., University of Pennsylvania, 1925; F.R.C.S. (Eng.), 1920; F.R.C.S. (Ireland), 1921; LL.D., University of Edinburgh, 1925; LL.D., Queen's University, Belfast, 1925; M.Ch., Trinity College, Dublin, 1925; M.S., Dublin University, 1925. Surgeon and Associate Chief of Staff, Mayo Clinic, Rochester, Minnesota; Professor of Surgery, Mayo Foundation, Graduate and Medical Schools, University of Minnesota. With his brother, Dr. William J. Mayo, established the Mayo Foundation for Medical Education and Research, in affiliation with the University of Minnesota, 1915. Colonel and Chief Consultant, alternating with Colonel William J. Mayo, for all surgical services, 1917-19; U.S. Army Medical Department, Commissioned Brigadier-General, M.O.R.C., U.S.A., 1921; awarded the Distinguished Service Medal, U.S.A., 1920; Legion of Honor (France), 1925. President, Western Surgical Association, 1904-05; President, Minnesota State Medical Association, 1905-06; President, Section on Surgery, International Congress on Tuberculosis, 1908-09; President, Society of Clinical Surgeons, 1911-12; President, Clinical Congress of Surgeons of North America, 1914-15; President, American Medical Association, 1916-17; Regent since 1913, President, 1923-25, American College of Surgeons; President, Clinics of the Inter-State Post-Graduate Assembly of America, 1924-25. Member of School Board, 1915-23; Health Officer since 1912; City of Rochester, Minnesota. President, Alumni Association, Northwestern University Medical School, 1924-25.



ISAAC ARTHUR ABT

Born in Wilmington, Illinois, December 18, 1867. Studied, University of Chicago, 1884-85; Johns Hopkins University, 1886; Chicago Medical College, Northwestern University, 1889-91. M.D., Chicago Medical College, Northwestern University, 1891. Interne at Michael Reese Hospital, 1892. Postgraduate work, Vienna and Berlin, 1892-94. Assistant Pediatrician in the clinic; Instructor in Physiology and Histology, Northwestern University Medical School, 1894-1902. Professor of Diseases of Children, Northwestern University Women's Medical School, 1897-1902. Associate Professor of Diseases of Children, Rush Medical College, 1902-08. Professor of Diseases of Children, Northwestern University Medical School, since 1909. Consulting Physician, Winfield Tuberculosis Sanitarium, Chicago Orphan Asylum, Provident Hospital. At present: Physician-in-Charge, Children's Department of St. Luke's Hospital; Consulting Pediatrician, Sarah Morris Children's Hospital, Chicago Lying-In Hospital. Medical Inspector for many years, at present a member of the Advisory Staff, Chicago Health Department. First President, Children's Hospital Society. President, Chicago Pediatric Society, Central States Pediatric Society, American Pediatric Society, Chicago Medical Society. Author: Baby's Food, 1917; and numerous monographs on subjects relating to diseases of childhood. Editor: Pediatrics, Practical Year Book Series, since 1902; System of Pediatrics, 1923. On November 4, 1927, the French Government, represented by Dr. J. M. LeMee and Dr. G. Illingworth Helie of the American Hospital of Paris, conferred on Dr. Abt the Cross of the Legion of Honor in recognition of his distinguished services as a pediatrician.

THE FREDERICK ROBERT ZEIT MUSEUM OF PATHOLOGY

Dedicatory Address[1]

By JAMES PERSONS SIMONDS, Ph.D., M.D., Chicago

Professor of Pathology, Northwestern University Medical School

Yesterday we dedicated this beautiful Archibald Church Medical Library with fitting ceremonies which emphasized the importance of books in medical education. Today we dedicate what is essentially another library, namely, the Frederick Robert Zeit Museum of Pathology. A museum is a library composed, not of books, but of things themselves about which books are written. A book is valuable only when by means of words or pictures it induces in the reader's mind the formation of a clear idea or stimulates or recalls a vivid experience. A museum accomplishes the same purpose not by the use of abstract words, but by means of the very material objects which originally induced a clear idea or originated a vivid experience. Hence in medical education a good museum is almost as essential as excellent textbooks. It has been said that "the conclusive evidence of lack of educational conscience and pride" in a medical school "is the absence of a decent museum."

A museum is essential to the effective teaching of pathology, which is the pivotal subject in the medical curriculum. During the first year and a half in the medical school the student is engaged in learning the normal structure, function and chemical composition and reactions of the human body. After accomplishing this, he is first introduced, in the Department of Pathology, to those changes in the body induced by disease. Disease causes alterations in anatomical structure, in physiologic activity or function and in the chemical composition and reactions in the body. The science of pathology takes cognizance of all of these changes, but those which affect the structure of an organ or part of the body are the most concrete, the most tangible and palpable, the most unequivocal, the most inescapable, and the least open to misinterpretation and misunderstanding. It is these changes in structure that are illustrated by the actual specimens in any well ordered museum. In such a museum the student becomes proficient in that division of pathology known as morbid or pathological anatomy.

Pathological physiology and pathological chemistry, although of very great importance, deal with forces and objects that are necessarily less concrete and less tangible than are those with which pathological anatomy deals. Hence pathological anatomy will remain the foundation upon which the superstructure of the study of disease must be built. It is true that some alterations of function and some chemical reactions are not accompanied by any detectable changes in structure, but these are the exceptions rather than the rule. To emphasize, at least to students, that functional

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[1]June 16, 1927.

changes can occur without structural alteration is dangerous, because it deprives them of the surest foundation for their medical thinking, namely, an anatomic basis.

The student who has seen and handled organs affected by various diseases is not likely to become a medical faker. A physician who in his student days has seen and handled a lung in a state of pneumonia and has found it transformed by the disease from a soft, pliable, spongy organ, to a solid, liver-like object with its tiny air sacs filled up with fibrin and leucocytes, will know that there is no drug which he can administer and no incantation which he can utter that will cause all of this material to dissolve and vanish suddenly, leaving the lung soft and pliable and filled with air; furthermore he will have learned a rational basis for the treatment of his patient and will accomplish greater results than with mumbled ritual or magic drugs. The student who has seen and handled a tuberculous lung and who, therefore, has acquired a clear conception of the destructive changes produced by tuberculosis will never have the conscience to prey upon the credulity of unfortunate tuberculosis patients by offering for sale some worthless remedy with alleged miraculous powers. After a student has actually seen cancer with its extension into adjacent tissues and the formation of secondary growths in distant organs, he will not, willfully or in ignorance, deceive his patients with false hopes based upon promises impossible of accomplishment. The physician who has seen the gross and microscopic changes in the kidney in Bright's disease will not be misled by the glowing descriptions of miraculous cures alleged to result from the use of advertised secret nostrums.

Pathological anatomy is, therefore, not only one of the most important subjects of the medical curriculum, but is also the very foundation of clinical teaching. Its purposes and functions can best be illustrated by three metaphors, each expressing a slightly different phase of this subject. It is a fly-wheel which guarantees the smooth running of the machinery of the medical mind and prevents racing of the engine of thought by too great power of enthusiasm. From another point of view, it is a rudder which enables the physician to keep a straight course through the maze of medical vagaries which each generation produces. And, finally, it is an anchor which prevents the practitioner of medicine from being blown about by every wind of medical doctrine. It is this very useful, fundamental subject of pathological anatomy that is taught in a museum of pathology.

Northwestern University Medical School is especially fortunate in possessing one of the finest museums of pathology in the United States, and one of the few really great museums of the world. This museum is the product of a keen and vigorous educational conscience. Its origin dates from the year 1899, when Dr. Gustav Fütterer, a former assistant of the great German pathologist, Rindfleisch of Würzburg, was appointed Professor of Pathology in the old Chicago Medical College, and Dr. Frederick Robert Zeit, who had been for three years a collaborator of Dr. Edwin Klebs, one of the discoverers of the diphtheria bacillus, was made his first assistant.

When Dr. Fütterer and Dr. Zeit began their work, the Medical School possessed a so-called museum located in one of the rooms on the first floor of the old building at 2421 South Dearborn Street. At that time a few cases arranged around the walls contained some relics of the Civil War, such as bullets, gun-shot wounds of bones, and so forth; a collection of bones and models for the teaching of obstetrics; and a number of jars containing hearts, livers, fibroids of the uterus, and cysts of the ovary, all so

poorly preserved that they looked too much alike to be of any value whatsoever for teaching purposes. The exhibits that were given the greatest prominence and occupied cases in the center of the room were a stuffed two-headed calf and the skeleton of an elephant with a broken collar bone! Dr. Fütterer and Dr. Zeit carefully sorted this old material and retained a few of the better specimens, some of which are still preserved in the museum as interesting historic relics.

These two men began collecting pathological material for the museum, and preparing and preserving it so as to retain the natural colors. Dr. Fütterer remained for only two years and was succeeded by Dr. Ohlmacher, who also remained but two years. Hence, beginning with 1903, for more than twenty years Dr. Zeit labored almost alone in building up the museum which now very appropriately bears his name. That this has been a labor of love with Dr. Zeit is indicated by the fact that during all of this time he was so handicapped by inadequate help that it was impossible for him to keep complete and accurate records of many of the valuable specimens. He was also handicapped by the lack of sufficient funds for properly developing the museum in many important directions; and by the very limited, poorly lighted floor space, which made it impossible to display the collection of specimens effectively. In spite of these disadvantages, on the two occasions on which parts of this museum were exhibited at meetings of the American Medical Association, certificates of merit were received.

The Museum of Pathology of Northwestern University Medical School, like every great museum, has been founded with the intent of accomplishing a definite purpose. It is not a place for the safe-keeping of curiosities. The skeleton of the elephant with the broken collar bone and the stuffed two-headed calf have long since disappeared. This museum is essentially a teaching museum. It is a great textbook in which the student can read the science of medicine in characters that are graphic and in language that is clear. Definite purpose and skillful selection have been exercised in the accumulation of the material of which it is composed. In this collection are specimens representing all of the common and most of the rare diseases to which man is subject. The Museum contains about four thousand specimens; but the source of pride is not the number of specimens, but rather the clearness with which, by preservation of necessary relations and characteristic colors, they illustrate to the student each of the disease processes which he will encounter in the practice of his profession. Specimens such as huge fibroids of the uterus or enormous cysts of the ovary, that impress only by their weight and size, and specimens of extremely rare and foreign diseases, occupy but little space in this museum. The merely spectacular has little teaching value; the rare and uncommon may mislead by giving a wrong sense of values and proportion.

The material is arranged in the Museum in an orderly sequence, so the student can read by means of the material symbols in this picture-writing *par excellence* the story of the various diseases which affect the lungs, or the brain or other organs of the body. In one group of cases he can see the changes produced by tuberculosis, in another, those caused by cancer, in almost every organ of the body.

The autopsy is an "indispensable adjunct" to the effective teaching of pathology, but the necessarily haphazard occurrence of pathological processes seen at autopsies cannot furnish the systematic view of disease which is presented in an adequate and well arranged museum of pathology. Hence the knowledge of disease acquired at the

autopsy table must be supplemented by the study of specimens in a museum. In this museum the specimens are so prepared that each explains itself. A small card attached to each specimen gives the name of the disease which it illustrates, and in many instances, the most important facts of the clinical history and associated pathology.

The material in this museum is used in teaching in at least three different ways: First, in the systematic course in pathology, specimens illustrating the disease being studied are demonstrated to the students, and the relations of the alterations in structure in the organ to the changes in its function, that is, to the symptoms of the disease, are pointed out. Secondly, any professor who wishes to give a lecture or a clinic applies to the Curator of the Museum and is supplied with illustrative specimens together with the necessary explanatory data. These specimens are placed in the lecture room before the hour set for the lecture. The Museum thus serves not only the Department of Pathology, which is its natural custodian, but the entire Medical School as well. During the past year the Department of Pathology of the Dental School also has made frequent use of this Museum. Finally, the Museum is open at all hours of the day. Instructors can send students to study particular subjects; the students after seeing patients in the hospitals and clinics can, and do, on their own initiative come to the Museum and are thus enabled to visualize the changes produced in the bodies of their patients by the diseases from which they are suffering.

On behalf, therefore, of the Faculty of Northwestern University Medical School, we do now dedicate the Frederick Robert Zeit Museum of Pathology to the high purposes of its founder; to the effective teaching of pathology in its broadest sense to students and practitioners of medicine; to the encouragement in students of all those qualities of mind which characterize true scholarship; and to the extension of accurate knowledge of disease and through this to a more complete conquest of disease. We record our feeling of appreciation and gratitude to Professor Zeit for his patient and persistent labors, which through many years of discouraging handicaps have made this Museum possible; and we express our extreme pleasure that he is enabled to see this Museum properly housed so as to display its full value and richness. The permanent association with the Museum of the name of this beloved and inspiring teacher and friend will forever inspire future generations of teachers in this Department as the material in this Museum will stimulate and instruct medical students.

THE JAMES A. PATTEN RESEARCH LABORATORIES OF BACTERIOLOGY

Dedicatory Address[1]

By ALEXANDER A. DAY, B.A., M.D., Chicago

Professor of Bacteriology, Northwestern University Medical School

We meet today to dedicate the James A. Patten Research Laboratories, which were established for the advancement of the science of medicine. Research has been defined as the act of searching into a matter closely and carefully, an inquiry directed to the discovery of truth and in particular the trained scientific investigation of the principles and facts of any subject based on original and first hand study of authorities or experiments. Investigations of every kind which have been based on original sources of knowledge may be styled "research," and it may be said that without research no authoritative works have been written, no scientific discoveries or inventions made, no theories of any value propounded.

Medical research in its broadest sense is as old as medicine itself. Doubtless, instinctive beginnings occurred in seeking relief from pain or protection from those experiences which produced pain.

Research in the science of bacteriology, for which these laboratories were primarily founded, had its beginnings with the Jesuit, Kircher, in 1659, and the Dutch linen-draper, van Leeuwenhoek in 1675. These men actually saw and described living beings belonging to the world of the infinitely small, too minute to be seen with the naked eye, which were undoubtedly, at least in part, bacteria. Plenciz of Vienna, writing in 1762, expressed a belief in the direct etiological connection between microorganisms and some diseases, and was the first to advance the opinion that each malady had its own specific casual agent which multiplied enormously in the diseased body. The opinions of this author came remarkably near to the truth, not only as regards etiology and transmission, but also in their suggestion of specific therapy. The conception of a *contagium vivum* was thus practically established with the work of Plenciz and many others who followed in his train, but the astonishingly slight impression which the acute reasoning of these men left upon the medical thought of their day is illustrative of the futility of the most penetrating speculation when unsupported by experimental data. The history of bacteriology shows strikingly that the results have been gained only through long and laborious research and after many obstacles have been met and overcome by accurate observation and experimentation.

Robert Boyle, working in the seventeenth century, prophesied that the mystery of infectious diseases would be solved by the investigator who would succeed in elucidating the nature of fermentation.

[1]June 16, 1927.

Spallanzani in 1769, Schultze in 1836, and Schwann in 1839, by their investigations showed that the spoilage of putrescible fluids is due to micro-organisms. It remained, however, for Pasteur in 1861, by his ingenious and accurate experiments, particularly with yeasts, to refute finally the doctrine of spontaneous generation, and at the same time lay the groundwork for the recognition of bacteria as causative agents of disease. It was the discovery of the living agents underlying putrefaction especially which exerted the most active influence upon the medical research of the day. This is illustrated by Lister's work. The suppurative processes occurring in infected wounds had long been regarded as a species of putrefaction, and Lord Lister, working directly upon the premises supplied by Pasteur, introduced into both the active and prophylactic treatment of surgical wounds the antiseptic principles and later the aseptic principles which alone have made modern surgery possible.

Soon it was demonstrated that micro-organisms were probably the cause of certain infectious diseases in man and the higher animals. Duvaine in 1863, in a series of brilliant investigations, furnished the proof that anthrax is caused by a specific bacillus. This was the first disease in which definite proof of bacterial causation was established. It is not surprising that the successes attained, fostering hope of analogous results in all other similar conditions, but without the aid of adequate experimental methods, resulted in the promulgation of many unjustified claims and too much fantastic theorizing. Extravagant conjectures, however, could not for any length of time withstand the light of the critical attitude which was already pervading bacteriological research.

Progress in this science soon became rapid and cannot be detailed here. With the publication of Koch's work began an era unusually rich in results previously held in leash by inadequate technical methods. The discovery of the typhoid bacillus in 1880, of the bacillus of fowl cholera and of the pneumococcus in the same year, and of the tubercle bacillus in 1882 initiated a series of etiological discoveries which, extending over not more than fifteen years, elucidated the causation of a majority of the infectious diseases. In 1882 Pasteur published his first communication upon rabies. A little later came the investigations of Loeffler and Roux upon the diphtheria bacillus and its toxins and that of Kitasato upon tetanus. These researches paved the way for Behring's work on diphtheria antitoxin, which in turn stimulated investigation upon the whole subject of immunity, with Bordet, Ehrlich and Metchnikoff as chief pioneers. Thus was born the daughter science—immunology.

These researches have made bacteriology one of the most important branches of diagnostic, therapeutic and preventive medicine. Apart from the importance in the purely medical sciences, the study of bacteria has also shed beneficial light upon many other fields of activity. In their relationship to decomposition, the conditions of the soil, and diseases of plants, bacteria have been found to occupy a position of great importance in agriculture. Furthermore knowledge of bacterial and yeast ferments has become the scientific basis of many industries, chiefly those concerned in the production of wine, beer and dairy products.

This heritage which has been bequeathed to us by the past is indeed a rich one. Its extent is in part testified to by this library, but its value to the thousands in the past and the thousands yet to come is beyond estimate. The present day and age is the greatest of all. Never before has man been so well equipped for investigation, for

observation, experimentation and deduction, and yet called to witness and believe so many miraculous demonstrations of ingenuity so seemingly impossible to understand. This gift should be received by us with a proper appreciation of its magnitude and so fostered that it may be passed on to future generations with increased value and far reaching effect. Our added knowledge and improved facilities find ever broader fields demanding investigation. Let us not be lured from the study and advancement of pure science by the temptation of and the urge for practical research. The foundation upon which we build must be strong and enduring. When narrow minds disdained everything in science which had no immediate application by saying, "But what is the use of it?" Benjamin Franklin replied, "What is the use of a new-born child?"

The functions of a medical school are to train practitioners of medicine, to train teachers, and to foster the progress of medical science. A survey of the evolution of research will show that in these days research can no more be divorced from medical education than can medical education be divorced from research. The members of the faculty should be given time and opportunity to engage in investigative work so that they may add to our store of known facts. Young men and women who show sufficient aptitude for such work should receive training and encouragement. It is the opinion of Carlson and others that every medical student should do a bit of research in some one field as a part of his professional training. There is much to be said for this, since it would tend to develop the critical and analytical faculties so essential to the physician. To quote Pasteur, "In the fields of observation chance favors only the mind which is prepared."

In 1910, James A. Patten, philanthropist and man of eminence in the business world, with a broad understanding of the needs of the present and a clear vision of the future, established a fund, the income from which was to be expended in scientific investigations of the factors that cause disease, and in a study of the defensive forces that protect the body against the microbes of disease. While this gift is unfettered by restrictions, the donor expressed a hope that attention would be directed to tuberculosis or some subject bearing on this malady. The laboratories operated by this fund were designated by the University as the James A. Patten Research Laboratories. Today we dedicate the new James A. Patten Research Laboratories in our new medical school to the advancement of the knowledge of diagnosis, treatment and prevention of infectious diseases and to the promotion of the well-being of mankind.

In 1912, Arthur I. Kendall became the first director of the James A. Patten Research Laboratories. Under his able direction and guidance numerous and varied investigations were undertaken and carried to completion.

As the science of bacteriology has advanced it has become apparent that bacteria are more important for what they do than for what they are. Consequently the methods of investigation have changed from the more botanical to a study of the changes which take place between bacteria and their environment. In these laboratories the logic of this conception was appreciated early and since it was realized that these reactions are largely, if not entirely, chemical in nature, chemical methods were applied in the various fields of investigation. Great advances in the understanding of the human body, both in health and in disease, have resulted from the study of its chemistry. Here, however, the situation is extremely complex, concerned as it is with an organism made up of innumerable cells of widely varied structure and activity. It

was conceived then that since bacteria are single celled organisms, among the simplest of known living things, readily available and controllable for experimental work, information might be obtained from them which would have application to the more difficult problem presented in the human body. This type of research has been conducted with representatives of most of the disease producing classes of bacteria and the kind and extent of their action upon proteins, sugars and to a lesser degree upon fats have been recorded in chemical terms. Certain outstanding facts have been disclosed. Foremost, it has been proved that those bacteria which can utilize sugar as a food will always do so in preference to protein when both are present. This scientific principle has been expressed as the sparing action of sugars for proteins, and has wide application in medicine, agriculture and the industries.

These experiments have done much to bring about the recognition of bacteria as exact and delicate chemical reagents. Methods have been elaborated which have taken cognizance of this characteristic for the identification and measurement of sugars in amounts heretofore not detectable.

Extensive researches have been conducted on the normal and abnormal bacteria of the intestines and as a result it has been demonstrated that the activities, or habits, as it were, of the intestinal flora may be changed by diet.

Chemical investigations of that group of micro-organisms which played such an important rôle in war wound infections have been pursued and considerable knowledge has been acquired which has added to the understanding and classification of these conditions.

Chemical methods of investigation have continued to be employed together with immunological and the usual bacteriological methods, with results which promise to add materially to the science of bacteriology and medicine.

It is my privilege to voice for the members of the Department of Bacteriology and for the members of other departments who have occasion to utilize these laboratories our appreciation of the good fortune and rare opportunity which is ours in having such splendid and adequately equipped laboratories in which to pursue scientific studies. We are likewise conscious of our responsibility to the donor whose munificence and comprehension have made them possible, to the University which sponsors these laboratories and in whose medical school they are housed, and to the science of medicine which they are designed to serve. We shall ever continue to strive to accomplish Pasteur's desire "to contribute in some manner to the progress and welfare of humanity."

THE NATHAN SMITH DAVIS PROFESSORSHIP IN PHYSIOLOGY

Installation Ceremony[1]

DEAN CUTTER: I present Andrew C. Ivy.

PRESIDENT SCOTT: By direction of the Board of Trustees of Northwestern University and under the authority of the Board delegated to me, it is my pleasure and duty to install Andrew C. Ivy as the Nathan Smith Davis Professor of Physiology. Professor Luckhardt will bring greetings from the University of Chicago.

DR. LUCKHARDT: Today Northwestern University not only looks back on a record of glorious achievement, but expectantly sets the time clock for an even greater record of accomplishment in education and in service to the community and the world at large.

In honoring Andrew Conway Ivy with the Nathan Smith Davis Professorship in Physiology this great institution has selected a man well qualified to do more than his share in the training of those intrusted to his guidance and in further extending human knowledge in its practical application to medical science.

Professor Ivy is not only an effective teacher, but a scientist of rare research ability. His success as a teacher is due not only to the fact that he can present the essentials of his specialty systematically and analytically, but—what is more important and too rare in these days—he presents them from the point of view of practical medicine. The same point of view has directed his research. Because of the quantity and quality of his scientific contributions he enjoys a reputation for productive scholarship which extends beyond our national boundaries. This reputation rests particularly on his brilliant contributions to the physiology of gastro-intestinal motility and secretion. In this field of activity he has shown the rarest type of scientific ingenuity and technical skill. In fact, his varied interests as judged by his scientific output denote not only a wide and intimate knowledge of the subject matter and its problems, but the perseverance and manual dexterity so essential to the ultimate solution of those problems.

Young in years but as cautious, careful and critical as the best at twice his age; as true and faithful to his science as he is to his friends and colleagues; as sure and accurate with his hands as with his head; as outspokenly uncompromising on questions of fact as he is immediately amenable to reason, Professor Ivy is a credit not only to this University and all other American institutions of higher learning but to the world of medicine at large.

I take great pleasure in being allowed the privilege of making these brief statements as a friend, a colleague, and as the least of his former teachers.

PRESIDENT SCOTT: The Dean will recommend the appointee.

DEAN CUTTER: Mr. President I have the honor to recommend that Andrew C. Ivy be installed and hereafter known as the Nathan Smith Davis Professor of Physiology in Northwestern University Medical School. He is eminently qualified and may be

[1]June 16, 1927.

trusted to emulate the noble example of the great teacher of Physiology and Medicine, Nathan Smith Davis, in whose memory the Chair of Physiology in this school is endowed by William Deering.

PRESIDENT SCOTT (ushers Dr. Ivy to the chair provided and seats him): I seat you, Andrew C. Ivy, in a chair designated for the time being as the Chair of Physiology. This chair symbolizes important academic responsibilities in the field of physiology, both in teaching and in research.

You are deemed a worthy incumbent of the Nathan Smith Davis Professorship. I admonish you to remain ever true to your high scientific calling; to be an example and stimulus to your students and insofar as lies within you to advance the boundaries of knowledge in your special field. A worthy successor to a great teacher, I now declare you the Nathan Smith Davis Professor of Physiology.

Professor Ivy will be invested with the robe of office by the Dean of the Faculty.

DR. IVY: Those of you who know me well are aware of the fact that on most occasions I am not at a loss for words. However, on this occasion, being taken by surprise and called upon for a response, I feel completely aphasic. My knowledge of physiology reminds me that animals, when they are confronted with an unexpected situation, must decide whether it will be met by flight or fight, the choice of alternatives being aided by the adrenals. Now, my natural inclination is to flee, but my cerebral activity has inhibited the execution of that desire, and I hope in this particular instance the "emergency function theory of the adrenals" is true and that my adrenals are functioning in a perfect manner.

All who are familiar with the history of Northwestern University Medical School and with medical education in America are aware of the marked pedagogical and inspirational abilities that were possessed by Dr. Nathan Smith Davis, after whom the Chair in Physiology is named. It is our desire in the Department of Physiology to promulgate and to practice the ideals of Dr. Davis by giving adequate attention to the systematic teaching of physiology to our medical students, so that they will appreciate and understand symptoms of disease and be able to treat them according to sound physiological principles; by inspiring our students to desire to learn more than the prescribed amount of physiology, so that after graduation they will continue to keep up with advances in physiology and medicine; by inspiring our students to observe and investigate new symptoms and pictures of physiological disturbances in disease, and to prosecute research on various problems, so that our knowledge of physiology and its application to the cause and cure of disease in man will continually advance.

Mr. President, Mr. Dean, Ladies and Gentlemen, I desire to express my keen appreciation of the honor of this position and of its incumbent responsibilities. My colleagues and I will attempt to the best of our ability to emulate the precepts and perform the duties necessary to uphold and further the ideas upon which rests the Nathan Smith Davis Professorship of Physiology.

THE ROBERT LAUGHLIN REA PROFESSORSHIP IN ANATOMY

Installation Ceremony[1]

Dean Cutter: I present Leslie B. Arey.

President Scott: By direction of the Board of Trustees of Northwestern University and under the authority of the Board delegated to me, it is my pleasure and duty to install Leslie B. Arey as the Robert Laughlin Rea Professor of Anatomy. Dr. Basil C. H. Harvey will bring greetings from the University of Chicago.

Dr. Harvey: Everyone interested in anatomy finds satisfaction and encouragement in what Northwestern University is now doing. These laboratories provide a place where anatomy can be studied, and the induction of Professor Arey into the Robert Laughlin Rea Professorship provides assurance that here anatomy will be studied effectively and helpfully. As anatomists we congratulate the University and the science. We see the way to a clearer understanding of the living human body.

It is the living body in which we are interested. Anatomy is a part of the science of biology, the science of living beings. The intensive study of it, often called research, follows four main roads; all of them leading toward more light.

Some investigators study the tissues after life has gone. They were the incarnation of human life. Through these structures, now inert and dead, life streamed and through them is seen something of the nature of the living body.

Some investigators study the living body as it develops. It begins as a single cell, an egg, but all the human body ever is or can be is in that cell. It is the real bearer and source of all human qualities. As development goes on and these qualities come steadily to clearer expression much light is thrown on the nature of the living body.

Some investigators study the history of our bodies. They realize that these small but perfectly human germ cells come from others before them and that these in their turn come from still others; that the series is infinite. Long ages before the first man appeared, his progenitors belonged to the animal kingdom. Here and there on this long road by which man has progressed he has picked up one by one his human and other qualities. Today, we *are* just those ancestral animal bodies made over. We *are* the living past. This age-long history throws much light upon the nature of our bodies as we live in them now.

Others seeing that our animal cousins share our ancestry and our qualities seek the light which animal bodies throw upon the structure and working of our own bodies, and by means of the experimental method, which can be used more freely in such study, have discovered *many* fundamental truths.

Professor Arey, whom we hold in affectionate respect, has made advances along several of these roads. As zoölogist, as embryologist, as experimental animal physiologist and always as anatomist, he has caused light from many sources to converge

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upon the problem which is central in all medical study—the natural history of the living body. We are confident that through these laboratories and through Professor Arey's work, science will be enlarged and human life enriched.

DEAN CUTTER: Mr. President, I have the honor to recommend that Leslie B. Arey be installed and hereafter known as the Robert Laughlin Rea Professor of Anatomy in Northwestern University Medical School. He is eminently qualified and may be trusted to emulate the noble example of the great teacher of anatomy, Robert Laughlin Rea, in whose memory the Chair of Anatomy in this school is endowed by his wife, Mellie Manlove Rea.

PRESIDENT SCOTT (ushering Dr. Arey to the Chair and seating him): I seat you, Leslie B. Arey, in the actual chair formerly graced by the presence of your distinguished predecessor, Dr. Robert L. Rea. This chair, presented to him by his students, symbolizes the high esteem in which he was held as a teacher of anatomy.

You are deemed a worthy incumbent of the Rea Professorship. I admonish you to remain ever true to your high scientific calling; to be an example and stimulus to your students and insofar as lies within you, to advance the boundaries of knowledge in your special field. A worthy successor to a great teacher, I now declare you the Robert Laughlin Rea Professor of Anatomy.

Professor Arey will be invested with the robe of office by Mrs. Mellie Manlove Rea.

DR. AREY: It was a peculiarly appropriate inspiration that guided Mrs. Rea to the establishment of this professorial chair in memory of her distinguished husband.

Dr. Rea, in the united opinion of his contemporaries, was the foremost anatomical teacher of his time. Relatively few years have brought important changes in the presentation of anatomical instruction. With these newer developments the didactic lecture which Dr. Rea used so effectively has largely become obsolete, yet the technique of teaching anatomy, due partly to contraction in the allotted time, is perhaps harder than ever before.

It is for this reason that the creation of a Chair of Anatomy bearing the honored name of one of the truly great exponents of the didactic method of teaching comes as a welcomed challenge. The importance of research is constantly forced into the consciousness of everyone. Good teaching, on the contrary, is too little stressed and too often neglected. Mrs. Rea has rendered a conspicuous service in establishing this perpetual reminder of the importance of sound pedagogy, seriously pursued.

There is another benefaction bearing the family name to which I should like to allude at this time, especially since it has never received adequate public recognition. In his will Professor Rea bequeathed a substantial sum of money to the University for the benefit of the Department of Anatomy. As a result there is appointed annually a young investigator who bears the title of Rea Fellow of Anatomy.

And so these twin benefactions, one to promote sound teaching and the other to encourage research, should achieve for husband and wife a certain measure of earthly immortality. Assuredly there should be—and there shall be—effected what the ancient Roman odist called a "monument more enduring than bronze."

As a representative of the Department of Anatomy of Northwestern Medical School, I am privileged to extend to you, Mrs. Rea, our deep appreciation of these munificent gifts, and to the University my personal pleasure in the honor which has been conferred by designating me as the first incumbent of this high office.

Part Four

GENERAL ADDRESSES

PROBLEMS IN MEDICAL EDUCATION[1]

By CHARLES H. MAYO, M.D., Rochester, Minnesota

Medical Counsellor
Northwestern University Medical School

President Scott, distinguished guests, citizens, and fellow alumni:

I wish to express my appreciation of the great honor done me in my selection as speaker on this occasion. Since accepting, however, my obligation seems greater and greater, especially before this inspiring audience and these magnificent buildings which are now dedicated to humanitarian service. Fifty years ago, buildings were more dependent on cornerstones than those built today by modern engineering; consequently we hope not so much depends on the way this cornerstone is laid.

One phase of democracy which is seldom considered is now brought to our attention, and that is the financial support of educational institutions that is always forthcoming from the prosperous. This has been true since our first universities were developed. We all appreciate that the cost of education cannot be financed by the income from the students. Therefore, all who have obtained higher education and have prospered by it are indebted to the world in direct proportion to their appreciation of the part played by education in their success, and they give willingly to aid in the education of the youth of coming generations. All who have given to this cause deserve and have the respect and appreciation of those interested in education and scientific development.

This day is a memorable one for it gives opportunity for us to come together in appreciation of the glorious past of Northwestern University and to voice our anticipation of a more remarkable future. The educational product, of necessity, will be, as it has been always, dependent on the ability of instructors and teachers to inspire and the capacity of students to emulate. Study within these buildings only plants the roots of knowledge; it does not make brains, but merely molds them and equips them for more and greater work. Medicine gives only to those who give, but her reward for those who serve is "finer than much fine gold."

It is forty-one years since I entered the Chicago Medical College which had already been taken over as the medical department of Northwestern University. The famous men in charge of that institution did their part in advancing the work of the

[1]Address given on the occasion of the Cornerstone Laying, June 11, 1926. See portrait and biography on pages 76 and 77.

whole university. To mention a few who were here then, I first name that great Nestor of Medicine, N. S. Davis, next Edmund Andrews, the surgeon, then Hollister, Johnson, Hay, Owens, Byford, and Dudley. With many others there was Frank Billings, who had just commenced teaching physical diagnosis. I made a choice of Northwestern because it was one of the first schools in the United States to develop a three-year course; all of the other schools in this city were then giving two-year courses in medicine. Yet they also laid a good foundation for many men with energy and capacity who have added distinction to medicine.

The Northwestern Medical School and the Northwestern Dental School have maintained their positions in the first rank of the Class A schools since they were founded. In these days of rapid expansion, when to fail to progress is to fall behind, the work accomplished is no small tribute to that remarkable guide and counsellor, President Scott. The alumni and all departments of Northwestern are awake to their good fortune in this regard and fully appreciate that he is most ably supported by the Board of Trustees. We welcome all advances which add to the educational requirements and the elevation of its product by the better training now given. An added light is thereby shed upon the alumni, and they are more proud than ever to say that they graduated from Northwestern University.

In those early days we had three years' instruction; some of our teachers had had less. A great deal of what they knew and taught has now been discarded, but the medical knowledge of that day was no easy thing to acquire. What was learned had to be remembered, since it had to serve with but few accessory aids. Men left the colleges with their intellectual packs on their backs to live by their own hands. They could not return for more supplies every summer, and the mails brought them little enough. They worked hard at their scattered practices, and they had to learn from their own observations. Every man had to do his own research, if he did not wish to stagnate; and that research was of all kinds the most difficult and exacting. With few accurate instruments, and without methods of precision, they had to wrest the secrets of disease from grudging nature. They learned from close observation the significance of a change in the pulse, the expression of the face and the very movements of the hands, but most by observation of the mouth in which are the signposts of many diseases of widely varying character and location. It is unfortunate that the dentist cannot advise the unsuspecting early sufferer, as yet unaware of impending doom, to seek aid. It would do some of our medical scientists much good to make the daily visits with one of the bygone veterans in the use of fingers, with eyes and a well-balanced brain developed by experience. The ability of these men to observe little things and to make themselves wiser in medicine from day to day was the fruit of their training, and actually of the limitations of organized study, as their methods served where today we depend more on the highly developed laboratories and technicians. It is wonderful what these men accomplished with their small amount of science and simple instruments. The enormous mass of knowledge of today makes it impossible for us to make as good use of our opportunities as they did of theirs, unless we work in limited fields. They often blundered, no doubt, but they did not earn the gratitude and reverence of a whole countryside merely by forsaking their beds to drive many rough miles through the storm.

They were able to learn as they went because they had been properly taught in the

schools, in spite of the fact that there was less general education to be acquired in those days. A day in school was a day robbed from the farm, as 70 per cent of the people were engaged in that occupation. The hours were golden, and a few had to serve for many. The students seized all the information they could and made it solidly their own, prizing their opportunities.

At the present time with all the special fields of medicine occupied by trained and experienced men, it may be said the family physician was never more needed. To him the patient first applies and on his diagnostic knowledge will depend whether he gives treatment to the patient or calls consultation. Only a few special fields of medicine have become sufficiently known to laymen to lead to their direct application for relief, and few men engaged in specialties pay much attention to associated diseases in other fields which may not be even recognized as they might have been by the general practitioner. In the future probably both the junior and senior students must pass the greater part of their time at the bedside to gain that experience necessary for diagnosis. Anatomy and physiology will again grow in importance as living topics directly concerned in disease. The fundamental studies of medicine will be taught by active medical men and less time devoted to specialism. The enormous additions to medical knowledge brought out within the last few years by workers in special fields of research will force departments for graduate study in the specialties; thus the eye next to the mouth will show the presence of more general and special diseases than any other region; and we see the future specialist acquiring a better training in general medicine than has been considered necessary in the past.

Since those early days we have developed our system of education until we can now point to it with just pride. We consider it a great advance on the struggling system of fifty years ago, and more suited to the intellectual growth of a nation than the European systems. But it is always well to remember that all change is not progress, and that changes are seldom all for the best. It may be that leveling up entails leveling down. It is difficult to apply any standardized system to widely divergent units. We have gone on from the principle of universal opportunity to that of universal compulsion. That brings its peculiar evils. Most educators of the present day see impending changes in educational methods and, although they appreciate the necessity for change, it will require some years and much experimentation to determine the best methods. England is returning to the tutor and individual instruction. Some of our educational centers are doing the same. The position of medical preceptor of fifty years ago may again rise in importance as a place for the medical student to learn practical applications of his knowledge when he has completed his medical and hospital course. Nobody would suggest for a minute going back to the old system, but it is just as well to remember that it had its advantages from which we can select the best to serve with those of today. There is nothing like a diet of salt herring to make a man appreciate a meal of fresh meat, and nothing like a year of long days on the farm to make a boy gobble all he can gorge himself with in six months of school. If the old stimulus is disappearing, we must find another to replace it.

In England and Germany there are common schools to equip the common people more fully for their duties as workmen, and a higher grade of school for the aristocracy to maintain their supremacy in mental equipment, to hold the national culture,

and make secure their positions as managers and owners of industrial organizations, and also to equip them for the governmental positions of authority in an autocracy. The great difference between our schools and theirs is that ours are more utilitarian. We attach more importance to the acquisition of facts that will serve in the daily occupation; they strive to lay a foundation that will be useful in any walk of life. We pursue our object from the outset by encouraging specialization in the schools; they reach less directly for the goal. We try to train a man to make one perfect cog in the machine; they believe that a man makes a better cog (and a better workman) if he knows something of the other cogs and how his will best fit into them. Here again we will not find our system perfect as it does not develop the man. Modern industry requires the human machine to fit one bolt or one screw to the machine as rapidly as possible for many years, or until the nervous system breaks; from such training little general progress can be expected. Our educational system may be the best yet evolved for financial advancement, but we must not think that the systems of other countries, particularly countries that have produced many great men for centuries, are inferior to ours in every respect. One of the signs of truly educated people, and a broadly educated nation, is lack of prejudice. Blind insistence on our own superiority is a confession of fear of our inferiority.

The old saying "come easy, go easy," applies to knowledge quite as well as to money. The power of retention is not what it was. Perhaps I am comparing the general run of today with the select of other days, but I see few men who remember in any detail what they once knew. The immediate goal of an examination is partly to blame, and there are different causes in different people; but I think the ease of acquirement is the chief cause. In the teaching of medicine the evil of "spoon-feeding" has long been recognized. The student must acquire as much as he can himself, both of facts and their interpretation, before he asks help. He blunders through his bedside and laboratory investigations to a diagnosis, and then finds how he is wrong or how barely right he is. Didactic instruction cannot be so ideally arranged. The student should hear the facts of medicine expounded and correlated only after he has familiarized himself with them by reading. It is a rare student, however, who keeps ahead of his teacher, and most are amply satisfied if they can read tonight what they have heard today. The new method to be evolved must give him time and opportunity to develop reason and judgment to apply the knowledge, or he too, as a result of this method of training, deals with only those bolts and screws which have become fixed in his memory.

Hundreds of problems in every sphere of medical science (chemistry, biology, physiology and pathology) await discovery by the scientifically-trained Bantings of the future. The new facts will need to be correlated so that their relationship to each other and to medicine will be apparent. No narrow scientist can do that, so we must fit an increasing number of men by broader training for the work of turning all these discoveries to use, not only in the practice, but also the science, of medicine. Northwestern is revising her methods to fit these needs.

There are two objects of medical education: To heal the sick, and to advance the science. There are bound to be many men in medical practice who are not primarily interested in either, and they may attain a certain measure of superficial success, even if the only joy of achievement they ever feel is in the contemplation of their bank

balances. Medicine is both an art and a science, and both make appeal to the true physician. The medical man of ancient time was versed in all the sciences of his day, and the great men of progress, like Copernicus, Galileo, and many others, were trained in medicine; but as new knowledge accumulated, science was divided into the branches of chemistry, biology, and, more recently, physics, as a special field. The rule-of-thumb man may be earnest, but he must look to others for guidance at every step. His idea of advancement is to learn new tricks in treatment. All his experience goes for naught because he has not been trained to profit by experience; he cannot carry the spirit of research into his daily work because he has not been medically educated. He has no scientific stability and his practice is governed by the last journal he reads or even by the last glowing circular that escapes the wastebasket. Fortunately, many such do not attend a regular medical college but slip in the back door of medical practice, and with limited study, become members of some cult which professes to cure all diseases by one method of manipulation, application, and administration of drugs. These men are, as a rule, harmless enough; the most serious consideration is the economic loss the country sustains by their diversion from their proper pursuits.

Much more dangerous is the narrow, so-called scientific, physician. He has been trained by a series of experts and he has adopted one particular field for his endeavors. He engages in research and may even attain some success as a technician. He discovers the existence of a certain phenomenon and duly records his triumph in print. He cannot relate his discovery to the universe of phenomena; he cannot tell how it may affect the world of medicine; he may not even be able to explain it; suffice it that he has observed a phenomenon.

This is the type of man who will gravitate into a specialty. If he pursues surgery he may attain considerable technical ability. He can never be a great surgeon because he has shed from him everything that does not pertain to the technical procedures. He will have an exact knowledge of anatomy and understand nothing of the principles of physiology; he will acquire a sound knowledge of the part of pathology that relates to structure, and ignore the vast field of chemical, biologic, and physiologic pathology. At most he will have a collaborator to throw him scraps of information to be added into the arithmetic process which constitutes his attempt at diagnosis. He will never grasp the conception of disease affecting the whole organism, never attain to that medical wisdom that is the hallmark of the great, because he was never a scientist but only a technician. But such a man as we have described will very rarely develop from the training he receives in Northwestern University. Such men naturally gravitate away from the better institutions into those where the course is easy and scientific knowledge limited in degree and application by its instructors.

The medical argument is not inherently logical. The conclusions based on experiment are seldom more than approximations of the truth, yet we constantly progress, new discoveries in one science advancing another. Experiments in physiology deal, so to speak, only with the superficial layers in the test-tube; results vary because of a fluctuating degree of contamination by deeper and unknown layers where we require the aid of the chemist and physicist. Blood in a test-tube is not blood in a vein, and it can only be assumed that, in what pertains to the experiment, the artificial

conditions have not caused material variation. When the experiment introduces abnormal conditions, which cannot all be measured, or which vary in different individuals, conclusions must be related to probabilities and not to certainties. Thus the reaction of the organism to wounding, whether by needle or knife, to hæmorrhage, and to anæsthesia is neither measurable nor constant. Even the pressure of the apparatus used to measure blood pressure provokes a varying response, and it can never be asserted that the conclusion is mathematically accurate; yet, as we are dealing with the widely varying cells of individuals subject to laws of heredity and changed by environment and disease, the experienced clinician can express surprisingly accurate opinions concerning both laboratory findings and the cause of symptoms. The intensive training of the research investigator makes his observations of great value to those who can interpret and apply them.

In physiologic experiments the difference between probability and certainty may be negligible or may be conjectured from repeated experiment. In diagnosis, however, the conclusion is a question of greater or less probability according to the experience of the observer. Diagnosis demands the exclusion of certain irrelevant data and the emphasis of the relevant. This ability to see in the chaos of history, symptoms, and examination of the patient the lines that make up the true picture is not acquired in the laboratory, but by study of diseased persons, and by sitting at the feet of those who have learned medical wisdom.

When a limb has suffered a fracturing blow, the technician's mind makes a prompt diagnosis of fracture of a certain bone, and dismisses the argument after laboratory confirmation. The scientist is not content to stop at the obvious. He may not be able to determine the local damage to other structures, the reaction of the organism to the injury, nor the reparative processes that begin far from the wounded tissue, but he wants to know. Therein lies the foundation of all progress. He is not satisfied with the obvious, not because treatment and prognosis depend on a deeper knowledge of what lies under his hand, so much as because the compelling curiosity of the true scientist demands satisfaction. Doubting Thomases have greatly advanced knowledge and developed scientific progress by investigation.

The high purpose of medical education is to fit the student to think in medicine; in fact, it can be said that education is a failure in that degree that it fails to train the student to reason and develop judgment as he acquires knowledge of disease and treatment and prevention as applied to the individual case. If we look after the average level, the prize-winners will look after themselves.

Medicine has a vastly wider field than it had a generation ago. Its very triumphs have brought it new difficulties and further obligations. With the aid of the economists, medicine has succeeded in upsetting the law on which evolution has depended for the progress of living creatures; now the unfit survive. However much we may glory in the triumph of humanitarian principles, and however impossible it is for medicine to travel any other road, we must not close our eyes to the evil of protecting and perpetuating the physically and mentally unfit. In thirty years the proportion of insane in our country has doubled. The appalling figures show all too clearly that diminishing mortality entails an increase in mental instability and criminalism. Out of the impossible situation which we are fast approaching, the world must be led by medicine, since nations decay and disintegrate from within.

The struggle for existence is passing; existence is certain. The struggle for bread has given place to the struggle for luxuries. The struggle to keep on living, the fear of age with its limitation of pleasure, are encouraged by our skill. We actually encourage impurity of stock, in defiance of nature's effort to maintain it by powerful instincts and by destructive disease. We have nothing to do with making the land fat, nor with its safety from war, but if our assurance of increasing health for all and safety from overwhelming epidemics tends to center the people's thoughts on their own safety so that they clamor panic-stricken at every ache, we may be slowly sapping the moral fiber and working untold harm to the nation. How to accomplish our good without evil is a harder problem than how to accomplish our good.

The ills of the age and of our race are not all physical, but they are closely interwoven with the problems of medicine. On our shoulders lies much of the burden of amelioration; our hearts must always be open to the demand of the world for betterment. The true physician will never be satisfied just to pass his therapeutic wares over a counter.

The stature of our new leaders in medicine will depend on the stature of our new generation of physicians, and it will not be high nor will it be appreciated by the people to any greater extent than the doctor can make manifest to them by his participation in the civic affairs of his community. The greatness of Moses was the greatness of a people with a fervor for freedom and a lofty belief in its own destiny; Napoleon sprang just a little farther than his fellows when the bonds of a nation were cut; Lincoln was the epitome of the humanitarianism that swept in a wave over the people of his day; the persistent struggle for light, the insistent demand of the age for an answer to the eternal question, produced Pasteur.

Let there be education in medicine commensurate to instruction; let the young physician be sound in the fundamentals, so that he may see his problem as it is, and his duty to himself, his patients and the science of medicine. Only so will he be able to comprehend the unity of the living organism, and view the picture of disease from all its aspects; only so will he measure up to his opportunities and take his proper place in the march of humankind toward perfection.

Those who have given most heed to the diverse demands on the physician's interest are those who are most sensible of the need for improvement in the methods of medical education. Many of the most eminent men in medicine have written on the subject, and the profession as a whole is more generally interested than at any time in its history. I have no fear that our system will fail us, since a clear understanding of our problem is nine-tenths of its solution.

I believe that these are the cornerstones, not only of a splendid institution of science, but of temples of education in the broadest sense. Here will the young men and women of the new generation get a sound grounding in fundamental principles and in their application to the service of the community. They will learn by precept and example how to advance science and enhance the position which it must hold in the physical, mental, and social health of the nation.

The many generous contributors may well feel they are opening the door to a new era in teaching and the broader use of knowledge. They have provided us with means; let us be equally generous with our interest and co-operation.

THE FOSTERING OF CLINICAL INVESTIGATION[1]

By LEONARD G. ROWNTREE, M.D., Rochester, Minnesota
Division of Medicine, Mayo Clinic and Mayo Foundation

This is a time for congratulations. This new building represents the acme of perfection. Man and his money can produce nothing better than this magnificent structure, so pleasing in its beauty and spacious in its planning, so creditable to Northwestern University and Chicago, so pregnant with possibilities for the good of the profession and the health of the people. What a splendid memorial! What an opportunity for service!

The building is the new home of the medical school, the house wherein it dwells. The school itself is a vital thing, a thing of flesh and blood—faculty members (past and present) professors, students, alumni—men and women with human interests, human aspirations and human weaknesses, working in a common cause. An institution such as this has life and spirit; it has memories and traditions to uphold, a reputation to sustain. It wields powerful influences, enjoys tremendous opportunities and faces great responsibilities. The building is but a dwelling place, the marvelous equipment and special facilities but instruments in the hands of the faculty for the development of doctors.

Health is essential to the happiness and welfare of the people. The physician is the guardian, his mission is to conserve health and cure disease. It is the boast of our civilization that luxuries have become necessities and that it should be no man's lot to toil from sun to sun. In the complexity of modern life competition is ever keener. Many must strengthen the hands that toil, so that one pair may produce more with less labor. There are those who shorten the hours of labor by perfecting machines, and those who help the laborer by protecting him and enabling him to work more efficiently. In this latter way the doctor contributes to society. And much more! He spares his fellowman pain and wretchedness, and adds considerably to the years of life and inestimably to the sum of human happiness. How widely the seeds of health will be scattered from this institution is to be the measure of its service. Success demands doctors who meet the needs of mankind.

Tonight I invite you to consider for a few minutes with me some of the opportunities and responsibilities of a medical school. Medical education is expensive, perhaps more expensive than the training for any other profession. It demands great buildings, such as this one which we now dedicate, expensive equipment, hospitals, laboratories, a faculty with diversified interests and a large personnel, the best that can be found among doctors, practitioners, specialists, scientists, teachers and investigators. Expense limits the number of such institutions, hence it behooves us to get the most out of every school of medicine.

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[1]Read at the Alumni Dinner, Northwestern University Medical School, June 15, 1927.

What are the essential attributes of the doctor? Character, professional proficiency and love of labor. The doctor should be a man of ideals and ideas who lives, thinks, and practices medicine, whose chief aim is service, and whose chief joy is the joy of accomplishment. Obviously, these attributes are fundamental. How large is the proportion of such men in our graduating classes? Are there many or few who place ideals above riches? The rigid examinations exclude the dullards, but there is at present no adequate way of protecting the profession against the intrusion of the intelligently unfit.

The selection and training of medical students is a great responsibility. This is no new problem, for it was considered centuries ago in the Golden Age of Pericles by no less a man than Hippocrates, the Father of Medicine. He says that "whoever is to acquire a competent knowledge of medicine ought to be possessed of the following advantages: a natural disposition, instruction, a favorable position for the study, early tuition, love of labor, leisure. First of all, a natural talent is required, for when Nature opposes, everything else is vain, but when Nature leads the way to what is most excellent, instruction in the art takes place, which the student must appropriate to himself by reflection, becoming an early pupil in a place well adapted for instruction. He must also bring to the task a love for labor and perseverance so that instruction, taking root, may bring forth proper and abundant fruit."

It is the function, then, of the faculty to select the students, reject the unfit and equip those who are eligible with a suitable background for whatever field of work they select. The faculty should know medicine and appreciate its needs, should understand human nature in health and disease, should be gifted with breadth of vision and endowed with wisdom especially for the guidance of youth. The molding of character, the creation of interests, the inculcation of ideals are as important faculty functions as the dissemination of knowledge. These are lessons not taught in books but only by precept and example.

Obviously, the medical school should be active in the advancement of medicine and in this connection it is imperative that the student should be taught that medicine is in the making. He should be made to understand the present status of medicine, together with its development, the channels through which progress has come; and above all, he should be taught to feel a sense of personal responsibility for its further advancement. In this connection, the faculty must learn that students cannot be directed into fields of investigation; they must be led.

Now and always, the greatest number of medical graduates will be practitioners of medicine, but there are always some with inquisitive minds who will investigate the unknown with the hope of advancing the bounds of knowledge and of furthering the conquest of disease. This essential difference in type was appreciated even in the earliest days of Greece. The first Greek poet of whose personality we are certain, Arctinus of Lesbos, 770 B.C., relates how Æsculapius "endowed one of his sons with nobler gifts than the other; for while to the one, Machaon, he gave skilled hands to draw out darts, make incisions and heal sores and wounds, he placed in the heart of the other, Podalirius, all cunning to find out things invisible and cure that which healed not."

I heartily subscribe to the idea that every possible effort should be made to fit medical students for medical practice. This means contact and associations with clini-

cians and training in the wards of great general hospitals of the Cook County type. It means breadth of training and diversified services, contact with sickness of all kinds and with practicing physicians of all types. But at the same time, I maintain that the school also has a great responsibility toward those few who desire to find out things invisible and cure that which heals not. This means laboratories, provision of facilities and especially of time for research. It means a faculty endowed with the spirit of investigation and active in medical research.

The story of medical investigation unfolds itself in the history of medicine. Progress always comes through ideas. Great investigators in medicine have appeared from time to time, have contributed new ideas, and in elaborating them have recorded new observations, recognized new facts, established laws, advanced the art of practice and developed the science of medicine. In the beginning, observation constituted practically our sole weapon, and in those early days, systems, authority and scholasticism held sway. But with Harvey, experimental medicine commenced; demonstrations and experimental proof were subsequently demanded; words, arguments, theories and authority no longer sufficed. Since his day, the application of the experimental method has resulted in progress which has been continuous and which is constantly gaining in momentum. As time has passed, the so-called basic or fundamental sciences—anatomy, physiology, pathology, bacteriology, and pharmacology—have evolved, have made fresh opportunity, and have absorbed the interests of the majority of medical investigators. However, in the field of actual practice, there still are left some who, while actually taking care of the sick, yet attempt to carry on research work. The world needs more clinical investigators, more Sydenhams, Hunters, Brights, Addisons and Oslers.

In fact, the great need of medicine today, as I see it, is for clinical investigators, men of scientific training, men who will accept the responsibility of the treatment of the sick and study disease as it actually is found in the homes, clinics and hospitals, and who at the same time will attempt to expand the bounds of knowledge. Let the medical schools choose and foster men with a sense of science, so that they may carry into their daily work that unquenchable spirit of investigation.

The spirit of investigation is a living force born within or rendered kinetic by contact from without, which, when first awakened is usually feeble and in need of cultivation, but when fully developed directs action and controls destiny. It is difficult to define, to understand, to acquire, to cultivate and to communicate, but in reality it exists and has all the driving power of religious fervor.

Investigation is complex. It demands certain mental attributes. The most essential are ideas and a veritable lust for truth. These must be supported by skill in experimentation, accuracy in observation and recording, correctness of interpretation of findings and due appreciation of their significance. Investigation consists of four essentials: an idea or clear conception of the problem to be solved, that is, a definite *Fragestellung;* the selection or development of methods capable of solving the problem; accurate measurements and records; and ability to recognize relationships, to correlate the results of the study to existing facts.

The spirit of investigation is necessary if one is to become an investigator, for without the spirit, research is merely a matter of technique, not of living. Planting is necessary. Seed time in medical life rarely lasts more than a few years. It is repre-

sented by the years in the medical school and those immediately following graduation. The faculty must be the sowers. Unless fruit is brought forth in the undergraduate years or within five years after graduation, it is rarely produced. In this period, environment is all-important, and at present, a laboratory sojourn is almost essential. The environment should include consideration of subsidiary factors necessary to production, such as time, space, facilities for work, inspiration, guidance, criticism, advice, and access to literature and to investigators. Growth at this period is as a rule not sufficiently advanced to permit the investigator to control these factors personally. The responsibility therefore rests on the sowers, that is, on the faculty and advisers.

The medical school should be a high-tension center capable of furnishing inspiration to all who come within its walls, and it should welcome especially and always its own alumni as well as younger graduates of other institutions, in fact all who have productive ideas and a desire to work. In the cultivation of the spirit, WORK (Osler's master word in medicine) is the master word. Only he who continues to work continues to advance or to lead.

Medicine has progressed as science has advanced. Modern medicine rests on science, science on investigation and investigation on measurements. With the modicum of science at his disposal, the busy practitioner is not equipped mentally, nor has he the time, the technique, nor the facilities to deal personally and unaided with the more complex problems of disease. The important thing is that he be kept in touch with those who are so equipped. The investigator must needs keep pace with contemporary science (in itself a big undertaking), and must apply the methods of science to medical problems as opportunity arises or can be created. As Galileo was engaged in the creation of the sciences of physics and mathematics, Sanctorius, through his assistance, was engaged in applying the thermometer and balance, that is, the new instruments of science, to the problems of physiology. This is as it should be. In these days physiologists and physiologic chemists at times intervene between the clinician and pure scientists. The field in medicine for the pure scientists is still great, despite the splendid contributions to medicine which are constantly being poured forth from the various laboratories devoted to the fundamental branches of medicine. Closer and more numerous contacts are desirable in order that the problem, as seen by the physician, may be placed first-hand and in its true light before the pure scientists. Physicists, chemists, and mathematicians should all be welcomed as collaborators in clinical investigation.

There is a practical side to this question of training physicians as clinical investigators. It takes money, not only to supply the facilities, but to support the beginner. Questions may cost nothing, but the answers are usually expensive. The present medical investigators either have funds available for extended study, or have been able to earn them in other pursuits. Undoubtedly the metal that comes through the hot flame of adversity is the finer, but the fires should not be so hot as to consume. Probably many men of scientific disposition find the practice of medicine as near to the science as they can ever come, and they live on substitutions. They ask questions, but their investigative spirit is stifled by the economic problem. They lack skill in investigation; they need a leader. Go to them, or bring them to you, and teach them how to set about finding answers. I should like to see universities and medical schools evidence appreciation of productive work in clinical medicine, especially by the award-

ing of scholarships for clinical investigation to alumni who are general practitioners. The university itself could confer some special degrees on young alumni, who, while engaged in actual practice, also make notable contributions to medicine.

But, after all, is medical investigation of such great importance? To the public generally, medical investigation makes no great appeal. The research worker is commonly regarded as impractical. Yet practice rests on investigation. Wassermann tests, studies of renal function, and studies of the spinal fluid constitute substantial phases of medical practice today, yet we did not have them twenty years ago. Insulin and parathormone were unknown even five years ago. Many physicians as well as the general public fail to see that *the conservative routine practice of today is based on the successful investigation of yesterday.* Clinical investigation means medicine based on science, better care of the sick, improvement in public health, and happier homes and communities.

The clinical investigator occupies an enviable position. He is in charge of the sick, and responsible for their treatment. On considering the matter, we find that the work of all of the fundamental departments converges on the patient. The clinician should bring to his patient experience, common sense and science, all that the medical laboratory can contribute and all that the biologist, physicist and chemist have to offer. In reality, the medical investigator can obtain assistance from all of the sciences in caring for his patient. His position is therefore crucial, and entails responsibilities as well as privileges. Wisdom often suggests the sharing of responsibility. Obviously, laboratory workers, even though physiologists and pharmacologists, cannot be given nor can they accept clinical responsibility. Hence they are barred from the clinic unless invited to share in the work. Their participation is usually of advantage to the patient and to the physician. A wise clinician will recognize his deficiencies and bring the laboratory to the patient. He will even try to bring the pure scientist into the closest possible contact with the practical problems of medicine. Investigation thereby becomes a group problem and further progress is made possible.

The most stimulating dissertation on clinical investigation that has ever come to my notice is Sydenhams' treatise *On Dropsy.* This is rich in philosophy and, though he states that "the steady observation of phenomena" has been his "instructor" and that observation is the "touchstone of those who profess medicine," he also states that "a little research teaches us how much knowledge is enough for the direction of those who claim for themselves the credit of being the healers of disease." If among you there be doubters, read the practical clinician Sydenham on dropsy.

To me Bright has always been the prototype of the clinical investigator. It is just a century ago that he assembled all of his patients with dropsy in one ward at Guy's Hospital and then undertook their intensive study. His laboratory equipment consisted of a spoon and a candle, and with this simple apparatus he worked out the significance of albuminuria, and enlightened the whole world on the subject of nephritis. He was a clinician of genius and also a pathologist, but he recognized the possibility of aid from chemistry. He struggled with this problem himself, and also brought to his assistance young men with scientific training: Babbington, who invented the laryngoscope, and Owen Rees, who evolved methods for the study of urea in the urine and blood. He adopted the system of group research and set before

medicine many of the problems with which we are struggling today. Some of you will remember how interestingly this is described in Wilkes' *Biography of Guy's Hospital.*

The accumulated experience of three centuries points to experimentation as the road to progress and to the correctness of Claude Bernard's vision that physiology must constitute the starting point of clinical investigation.

In your plans for further development see to it that adequate provision is made for clinical investigation. You now have this magnificent School of Medicine. Get your hospitals surrounding it, and plan to do it soon. The hospitals and medical school need each other and need to grow together. Do not be satisfied to sit and wait for ten or twenty years for this development. Be active for the development of hospitals in the near future. I am convinced that if the faculty and alumni of the institution put themselves to the task that the hospitals will be built within five years, or, at most, in ten years, and the advantages gained from the early completion of the organization will be well worth your best effort and enthusiasm. In planning the hospitals bear in mind clinical investigation. Bring in young clinicians who are trained in the fundamental sciences and who are interested in investigation; give them wards, laboratories and assistants and set them in the way of clinical investigators.

We all recognize the tremendous contributions that Northwestern University has always made to medicine and medical progress and this plea of mine that hospitals be forthcoming soon and that clinical investigation be carried on by doctors actually engaged in the care of the sick, would, I am sure, meet with the approval of the founders of the medical school, Hosmer Johnson, Edmund Andrews, Ralph Isham, Nathan S. Davis, William Byford, John Hollister and David Rutter. This school of medicine must surely produce graduates in the future to compare favorably with those of the past and present of the type of John Murphy, Frank Billings, Charles Mayo, Charles Elliott, Franklin Martin, Henry Plummer and Allen Kanavel. An institution that leads the profession in medical thought and practice will constitute a "place well adapted for instruction," a fitting environment for the training of medical students.

THE CORRELATION OF LABORATORY AND CLINICAL TEACHING[1]

By S. WALTER RANSON, Ph.D., M.D., St. Louis

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Until about twenty-five years ago the preclinical sciences were taught by young practitioners whose interest was centered in those phases of their subjects which could be most directly applied to medicine. During these years the relation between clinical and preclinical subjects was so close that the sciences could scarcely be said to have had a separate existence and certainly offered no opportunity for productive scholarship.

The improvement which has been achieved in the past quarter of a century is astounding and nowhere has progress been more evident than in this school. With its spacious and well equipped laboratories and its superb personnel, Northwestern University is now prepared to do its full share in the further development of the fundamental sciences. Each science must necessarily develop in and for itself and must be its own justification. None should be hampered by utilitarian motives, nor by the demand that intellectual interest be subordinated to practical application.

Nevertheless from many parts of this country we hear the demand for a closer correlation between laboratory and clinical teaching. Formerly the young surgeons, who in more or less rapid succession presided over the dissecting room, taught a species of surgical anatomy. As a result of the swinging of the pendulum in the opposite direction a number of our leading anatomists today refuse to recognize any necessity for preparing students for the study of medicine and surgery.

The outstanding problem in medical education is this: How can laboratory and clinical departments, while each remains free to pursue its own proper objectives, so co-ordinate their teaching as to give the student an intelligent understanding of medical problems rather than a jumble of unrelated facts.

The nervous system offers the most attractive field for an attempt at a closer correlation of the work of the various departments. It is now generally recognized that in this field structure and function must be taught together. The student is led at the very beginning of his neurologic studies to think of the nervous system in its relation to the rest of the living organism, and to understand how the nerves enable the body to adjust itself to its environment and integrate the activities of its several parts. This leads naturally to a study of the maladjustments caused by a diseased nervous system.

To quote Henry Head: "The charm of neurology, above all other branches of practical medicine, lies in the way it forces us into daily contact with principles. A knowledge of the structure and function of the nervous system is necessary to explain

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[1]Read at the Alumni Dinner, Northwestern University Medical School, June 15, 1927.

the simplest phenomena of disease." In no other branch of medicine do anatomical considerations play so large a part in diagnosis.

If the student is to acquire a useful understanding of the nervous system there must be a careful selection of the topics studied—the time available for anatomical neurology is not sufficient for a complete presentation of the subject.

For instance, the parts of the brain which are responsible for the sense of smell are extremely complex and intricately connected. For the student to study them in detail would require all of the time now allowed for the entire course; but having mastered the subject of the olfactory tracts and centers in the anatomical laboratory, he would practically never be concerned with it again. Why waste his time when there is so much of interest to be learned about the cerebral cortex, internal capsule, brain stem, and spinal cord—topics which recur repeatedly throughout the medical course. Concentration on these and other important regions lays a solid foundation upon which the physiologist and clinician can build. This makes possible that superposition of new observations upon former experience which is the very essence of sound pedagogy. It leads to an intelligent comprehension of the entire subject instead of the memory of isolated facts.

The task of correlating the teaching in the several departments of a school is necessarily focused on those subjects which follow rather than on those which precede. The clinical neurologist should insist that the student approach each case as an illustration of the faulty working of some part of the nervous system. Nature is constantly performing the most interesting experiments. The rupture of a small artery makes a sharply circumscribed lesion in the internal capsule interrupting descending and ascending fiber tracts and thus producing spastic paralysis and impaired sensibility on the opposite side of the body associated with hemianopia. No experiment in the physiological laboratory could be more instructive than this if the student is required to determine from the symptoms what tracts have been interrupted and then to locate the spot where all these tracts are so closely related that they could be destroyed by a single lesion. When clinical neurology is presented in this way the student finds that he is not entering upon a new subject, but is merely studying the structure and function of the nervous system from a new aspect.

I am glad to have had this opportunity to present my ideas on the teaching of neurology before this Alumni Association, because neurology is a field in which Northwestern University occupies a strategic position. It is in a position to profit by the wise counsel of Church and Patrick, neurologists of solid achievement and international reputation; and there is now on the faculty a group of young men interested in the nervous system, whose acumen and tireless enthusiasm give promise of great things to come. Some of these men dream of a large institute to be the center of neurologic teaching and research in this country. We believe that dreams come true.

THEN AND NOW[1]

By HUGH TALBOT PATRICK, D.Sc., M.D., Chicago

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Man is not always wise according to his years. Intelligence tests show that a man of thirty may have a mental age of only five years, and that when his years have reached fifty, his intelligence still remains that of a child. Nor is a country always mature in proportion to its chronological age; a very old country may be quite infantile. Our nation is young in years, but it seems to have shot through infancy and adolescence with incredible rapidity. An attempt to comprehend this speed almost gives one intellectual vertigo.

When that precocious and rather unmanageable boy, Benjamin Franklin, quit his native Boston and emigrated to the swifter city of brotherly love on the Delaware, Boston had a population of scarcely 10,000; New York was a bustling city of 7,000; and Philadelphia claimed 5,000 souls. One hundred years later Chicago was not even an unborn village, yet it now has two suburbs each with a population twice as great as the combined population of New York, Boston and Philadelphia at that time.

No less breathless has been the advance of medicine in the Middle West. Only ninety years ago the first charter for an educational institution in the State of Illinois was granted. That charter was for Rush Medical College.

At that time and for a long time thereafter medical education was pursued in doctors' offices. The medical student "read medicine" with a preceptor who was his teacher and guide. Likewise the student generally took care of the preceptor's horse, swept out the office (when it was swept), put up powders and made pills and was all-round handy man for the doctor and his household.

That the preceptor often was ignorant, sometimes careless and lazy, was inevitable. That the student should learn much or rapidly was not to be expected. That sometimes he did pick up a good bit of information we know, but it was a hit and miss education. The raw student was gradually transformed by a sort of fireless cooker process into a more or less inchoate mass that gradually oozed into the practice of physic. Frequently there was no doctoral nativity. Little by little the quondam student acquired patients from a frequently distrustful but always necessitous public. Sometimes there was birth by licensure. If he were a bright chap or had influential friends, he might get a license from the state or country medical society, if his state happened to make provision for a license.

When the preceptor chanced to be energetic and ambitious and better informed than his colleagues, he was apt to accumulate two or three students. Before there was a medical school in Chicago, Dr. Daniel Brainard, founder of the first school, was lecturing to as many as eleven students. The medical college of the time was a

[1]Read at the Dedication Convocation held at the John B. Murphy Memorial Building, June 16, 1927.

natural outgrowth of this system. Three or four such leading practitioners would organize a medical school, sometimes with, often without, a charter.

Such a school was only a step or two ahead of the preceptor. Half-baked or slightly singed practitioners came in to rest and brush up. With them the boys of no educational background took daily doses of anatomy, physics, surgery, obstetrics and materia medica. Practitioners and youths alike took the same scrambled mental pabulum. If the school had a charter, some of these rough and unready students after a course of from twelve to sixteen weeks were invested with the full panoply of Doctor of Medicine. If the school had no charter, often, by agreement and with a *quid pro quo,* its graduating class was shipped to a more fortunate school, perhaps in another state, where the doctoral investiture was accomplished.

These early medical colleges were really founded on courses in anatomy and each budding school had to get or tried to get dissecting material. Every ambitious preceptor with a student or two made the same attempt. Since there was no legal way to obtain cadavers, grave-robbing consequently was actively pursued and covertly encouraged by the medical teachers in and out of schools.

At Franklin Medical College, which had its habitat upstairs in the dwelling of Dr. Richards, at St. Charles, Illinois, an armed mob demanded the return of a body stolen from a grave in the town of Sycamore. The doctor's family fled over a stone wall in the rear but the doctor, failing to pacify the assailants, locked his front door and braced himself against it. One of the mob shot rifle bullets through the door, thus crippling the doctor for life and mortally wounding a loyal student, supposedly the thief, who stood beside the doctor. This fracas, in 1849, put an end to that medical college.

The medical department of Illinois College at Jacksonville had gone out of business one year earlier for similar reasons. An angry crowd surrounded the college and accused the professor of anatomy of having stolen even the body of Governor Duncan. Another professor faced the mob. He must have been clever and eloquent for he persuaded the outraged populace to disperse quietly. Grave-robbing was unpopular with all classes of citizens, and as the school could not run without dissection, it was finally abandoned.

To the medical student of today this may sound like a page of mediæval history, but such things occurred not so very long ago. Years after I was in practice I heard Dr. Blank, one of the original professors of what is now Northwestern University Medical School, relate some of his numerous adventures in body-snatching and tell of his adroitness in evading the clutches of the law. And Dr. Blank was a Christian gentleman.

I am myself the titular possessor of a still unused cadaver stolen by two medical students from an infirmary graveyard and hastily buried elsewhere a few inches deep to avoid imminent detection of the robbery.

When I was in high school one of my classmates was contributing to the family exchequer by taking care of Dr. White's horse. Early one morning he went into the haymow to throw down some horse feed, and when he took up an armful of hay he found himself embracing a corpse. Now, Dr. White was one of the town's most respected physicians and his son was studying medicine with him.

The population of the towns in which the first five medical colleges of the Middle

West were started was approximately as follows: La Porte, Indiana, 1,400; St. Charles, Illinois, 1,500; Jacksonville, Illinois, 2,300; Chicago barely 7,000; Rock Island, Illinois, 1,500.

As Chicago had as many inhabitants as the other cities combined, one can understand the good faith of the assertion in Rush Medical College's first announcement: "The superior facilities for medical instruction presented by Chicago cannot be denied."

Although the idea of a medical college in Chicago was born in 1836, when the population was 3,000, and the charter obtained in 1837 (before Chicago was incorporated), the school was not opened until 1843. The town then was partly on and partly in a morass. The people went about precariously treading wooden sidewalks built on stilts, or struggling through mire or wading through dust. In the spring, wary teamsters kept an eye out for signs stuck here and there warning, "No bottom." Dr. Brainard had come to town on a little Indian pony, and both the Doctor and the pony were rather seedy-looking. Does this sound like remote antiquity? I myself was a patient of this same Dr. Brainard.

Pecuniary emoluments were meager. Many a practitioner eked out his slender professional income by farming, preaching, or teaming. Sometimes they served as lawyers or judges. Dr. Brainard for a time was editor of the Chicago *Democrat*. In his interesting monograph Dr. Weaver tells of one of these pioneer doctors who in one day visited his patients, tried a law suit and preached a funeral sermon.

Such was the state of affairs when Rush Medical College came to life as an organism made up of four energetic men, two rented rooms and an adjoining shed. This faculty of four was assembled with some difficulty from three towns in two states. The financial foundation of the school was about as insecure as were the wobbly sidewalks of the town. Twenty-two students contributed a total income of $1,430, provided all of them paid the fees, which is unbelievable. One man was graduated, and paid $20 for the honor.

The next year some real estate promoters gave the faculty a lot and helped them put up a building costing $3,500. That year there were forty-six students and the graduating class numbered eleven. Eleven years later the faculty at its own expense enlarged the building at a cost of $15,000, and claimed accommodations for 250 students.

We now come to a great step forward in the medical affairs of this country. In 1844, young Dr. N. S. Davis of New York State began agitation for better medical education. He was logical, forceful, persistent. In consequence he was called to Chicago in 1849, where he at once began to teach and where for the next ten years he vainly fought for the introduction into medical schools of reasonable pedagogy and higher standards. Others contended for the same unattainable things, unattainable because medical schools were private enterprises. Competition was keen. Income came from the fees of students alone. Each school feared to raise its requirements because such provisions would drive away students. In national conclave the teachers would advocate reform, but they would later go home and vote the other way.

Finally, however, in 1859, four Chicago physicians: Drs. David Rutter, Hosmer A. Johnson, Edmund Andrews and Ralph N. Isham, and the aspiring embryonic Lind University, took their courage in their hands and founded a medical school on

a higher plane than had yet been attained on this western hemisphere. At once Drs. N. S. Davis and W. H. Byford on invitation joined the four others and thus was born what is now Northwestern University Medical School, the first school in the United States to require a three-year graded course, the first school to be founded and run for the benefit of the medical student and the long-suffering public.

For three years Lind University gave its medical department the use of six rooms on the second and third floors of the Lind business block. This constituted the school's home. All other expense was borne by the faculty. After three years Lind University, as such, died and this school became, like the others, a private business owned by members of the faculty. But to their honor be it said that they kept up their advanced standards, erected for themselves a new building and carried on. Furthermore they carried on alone for a long time, for other schools were slow to follow their gallant lead.

To convey some idea of the molluscan progress of medicine then and later, I venture to intrude a personal item. In 1884 I was graduated from one of the best medical colleges in the country, after attending two courses of lectures, each the exact duplicate of the other; without having looked through a microscope; without having seen a case of labor; and being utterly devoid of practical training in physical diagnosis, never having taken a medical history and having received no vestige of bedside instruction. And was I in consequence one of the submerged tenth? Not at all. By competitive examinations I received appointment as interne to two different New York hospitals and took my choice. In other words, most of the contestants were about as ignorant and untrained when they finished medical college as I was. Some were worse.

In order to present the contrast between then and now at all adequately would require many hours. In Chicago today each of the four medical schools instead of being an unstable private enterprise is an integral part of a great university. Their 1,844 well prepared students pursue a four-year, carefully arranged curriculum, guided by 108 professors and 727 assistants. After the four years each student spends one year as an interne in some hospital. These schools have sixteen buildings valued at $17,000,000, with an equipment which cost $2,000,000.

Whence have come these imposing structures, this rich equipment? Of course doctors were the originators and have contributed generously but most of the financial assistance has come from the public, either through private munificence, legislative enactment, or church support. Since the public has valiantly helped to build up these wonderfully efficient schools of medicine, what have the doctors done in return for the public? No ten-foot shelf of tall volumes would be half big enough to tell the whole tale. I will merely outline a few of the chapters:

The doctors have discovered the cause of tuberculosis and the means of restricting its ravages. They have discovered the cause of Asiatic cholera, how the disease spreads and how it can be suppressed. They have discovered the cause of malaria, the way it is transmitted and how to eliminate it from a community. They have discovered the cause of the plague, how it is disseminated and how to control it. The nature of typhoid fever is now an open book and no community needs to have a single case of it. Every death from typhoid fever is a reproach. The germ of diphtheria has been discovered and death from this dread disease is absolutely

unnecessary. The germ of syphilis has been isolated and its presence in the body can be detected by a relatively simple examination of the blood. Two Chicago doctors have discovered the germ of that scourge of the home—scarlet fever, and, what is more, how to prevent and cure this disease. Yellow fever is no longer the *bête noire* of the tropics; its cause we know and its extinction is only a question of efficiency. Doctors have learned how to detect and how to eradicate hookworm disease. The recent discovery of insulin has almost taken the die out of diabetes. What doctors have learned about infant care and the reduction of infant morbidity and mortality could not be told in a large volume. Cretinism and myxœdema are no longer the bane of certain localities. Last but not least in my pitifully fragmentary list, doctors have discovered the cause of the various septic infections and have perfected practical asepsis.

What does all of this mean to the man on the street? How does it concern the millions of human organisms swarming about their manifold activities in this mundane cosmos? A week would not suffice for the answer. I can give you about ten minutes' worth.

In the fourteenth century the plague killed 25,000,000 people. One-fourth of the population of Europe perished. If Europe were now to lose one-fourth of her people, say 100,000,000 men, women and children, the cataclysm of the World War would in comparison have been a mere minor calamity. In 1665, of the half million people in London, 70,000 died of the plague. That would correspond to 420,000 deaths in Chicago now. Civilized countries no longer have the plague.

How about cholera? In the pandemic of 1892, 800,000 persons died in Russia alone. In twenty years more than 7,000,000 persons have died of this disease in India. France lost 150,000 in one year, and the city of Hamburg lost nearly 7,000 during the same year. Now no country needs to have cholera.

From yellow fever New Orleans has lost 40,000 souls. In one year Barcelona lost 20,000. It has cost Rio de Janeiro 25,000 and Havana 36,000 lives. Memphis paid a toll of over 5,000 lives in 1878, but has not had a single case in the last thirty years. This disease is a thing of the past.

In the good old days in many parts of the South and Middle West hundreds of thousands of persons were disabled every year and many died. Some of us can remember when "the shakes" was a common complaint.

Formerly in epidemics of malignant diphtheria or scarlet fever, all of the children in a family would die. Parents were terror-stricken and doctors sweated blood. Now these diseases are no longer a horror.

In 1893 there were 20,000 cases of typhoid fever in Chicago. Now with more than double the population, there are only one-tenth as many cases, and should be none at all.

Hookworm, which formerly often made a southern community almost useless, is being exterminated and should soon be extinct.

Literally millions of children are annually saved from death and deformity because of what the doctors have taught us.

Finally, what does the accomplishment of asepsis mean to you and to me and to the world? It means that annually hundreds of thousands of operations are performed successfully which otherwise would be impossible. An operation for appendicitis is

scarcely an event nowadays, excepting to the patient. How many valuable lives this one operation has saved in the last forty years, no one can guess. Only fifty years ago appendicitis as such was unknown, and had it been known, in 90 per cent of the cases operation could not have been performed successfully.

All over the world, countless surgeons are performing operations in the abdominal cavity, in joints, on the brain, and on the spinal cord and doing it successfully; things not even dreamed of in the old septic days. Not counting mere numbers of lives saved, who can estimate the value of the life of one great man saved for years of usefulness? One of the most influential men in the United States government today would have died of brain tumor years ago if modern medicine had not made removal of such a growth possible. Can a statistician estimate the value of the lives of 10,000 mothers? Since the introduction of antisepsis, more than that number of lives have been saved in Chicago alone. Puerperal sepsis is now evidence of guilt—the guilt of culpable ignorance or carelessness.

When we have finally finished recounting the lives saved, perhaps we might mention disabilities removed or prevented. What is the economic value of 1,000,000 men and women rescued from chronic invalidism, saved from being lifelong cripples? Morbidity-saving operations on bones, joints, eyes and ears; prevention of chronic suppuration; removal of tumors; plastic surgery: these are now all in the day's work, but were formerly impossible procedures.

Also, what of relief from suffering? Who will ever be able to write the Anthem of Anæsthesia? Only a seraph who has suffered torture could write it. Only a celestial choir could sing it. No martyr of old ever suffered more agonizing pain than that of the victims of trifacial neuralgia, but every case of it can be relieved today.

Finally, in this practical age, one may not escape saying a word of the value of life and health to productivity in the realm of agriculture, industry, and commerce. Dead men tell no tales, neither do they raise wheat, build skyscrapers, run trains, or sail ships. Men who are sick and disabled are worse; they not only cannot work but they add to the burden of others.

It has been roughly estimated that the monetary value of all of the medical schools of Europe and America together with their equipment is about $800,000,000. What, forsooth, is such a paltry sum as compared to the mere money value of the lives saved by medical men? If a human life is worth $5,000—about the ordinary statutory estimate—one pandemic would cost $5,000,000,000 in lives, and at least a like sum in damages to production and commerce; that is, twelve times the value of all of the medical institutions in Europe and America. But, doctors have shown us how to abolish epidemics and pandemics forever.

From this iridescent and overwhelming array, are we to conclude that we have arrived? May the immortal spirit of Science and the good angel of Humanity forbid! The great archeologist Breasted says that "the capacity of man to rise from bestial savagery to civilization . . . is the greatest fact in the history of the universe as known to us." This buoyancy of the human spirit, this inherent urge to rise, to go forward, assuredly is the greatest thing in man. In spite of strange local fluctuations, in spite of isolated areas of retrogradation and mysterious focal infections of the spirit, man appears to be born to rise. And, thank the supernal powers that be,

this upward urge is with us still. We have our modicum of Bergson's *élan vital*. It is fortunate we have for there is so much, so very much, yet to be done.

The problem of that malignant pest, cancer, still remains unsolved. Though we know the cause of tuberculosis, means of preventing it or of quickly curing it are yet to be discovered. Of the 110,000,000 people now in the United States, 9,000,000 are doomed to die of this disease, victims of our ignorance and inefficiency. We can capture and cultivate the pneumococcus, but we can neither prevent nor cure pneumonia. Poliomyelitis and that terrible disease, lethargic encephalitis, now occupy the satanic thrones formerly held by diphtheria and scarlet fever. Before these somber kings we acknowledge our impotence. Influenza still roams the world at will and vagrant infections prey on all of us from day to day. A million exasperated men and women bitterly complain that no one has cured their arthritis and neuritis. A million more go on year after year suffering from migraine headaches.

Morbus sacer (sacred disease) of the ancients, now called epilepsy, is almost as mysterious to us as it was to Galen. We do not know why people have tumors, nor can we remove some of the tumors without operation. General paralysis and tabes crawl among us, a deep reproach to modern science. Today the nature of multiple sclerosis is as obscure as it was when the disease was first recognized.

Even though malaria is so well understood and is considered to be a quite needless disease, one hundred million persons have this disease and one million die as a result of it every year. Plague is also unnecessary; but from 1898 to 1923, 10,000,000 persons in India died of this disease because public and governmental knowledge had not reached the level of medical science. Are not these admonitory monuments to the tragic state of things as they are?

If these and a host of other pathologic conditions of the body and of the body politic cry aloud for correction, what of the psychoses and psychoneuroses, these even yet mysterious maladies of the spirit? If morbidity exceeds mortality more than 300 to 1, Omniscience alone knows how much of the morbidity is due to functional nervous disorder. It is *par excellence* the disease of personal maladjustment and renders miserable millions of people of all strata of society. Theoretically all of this suffering is preventable, but we are a long weary way from preventing it.

For medicine to continue to grow as the interests of mankind and the evolution of the race demand, the public must needs provide better facilities for research, more hospitals, a larger personnel and infinitely greater endowment.

PART FIVE

SCIENTIFIC PRESENTATIONS

DISTURBANCES IN PHYSIOLOGY IN CASES OF TOXIC THYROID

By ANDREW C. IVY, PH.D., M.D., CHICAGO

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INSTEAD of speaking specifically on the disturbances in physiology which occur in cases of "toxic thyroid," I will review briefly the related physiology of the thyroid gland.

Does the thyroid gland give off an internal secretion? It is well known that an extract of the thyroid can be made which, when ingested, stimulates metabolism, morphological differentiation, and growth, and that administration of this extract will control for the most part the deficiency symptoms resulting from the removal of the gland in young animals. As a result of the purification of this extract we now have a crystalline material which can be synthesized, which is chemically related to the amino acid tyrosine, and which when administered is as efficacious as the crude extract, with the exception that the extract seems to yield better therapeutic results in myxœdema than the pure material, called thyroxin.

This is good evidence that the thyroid gland gives off an internal secretion, but does not satisfy the skeptically minded person. However, it has been shown recently that thyroglobulin will form precipitins when injected into rabbits. When such precipitins are used, it has been shown that the lymph and blood coming from the thyroid gland contain thyroglobulin, thus proving that the thyroid does give off a secretion to the blood and lymph.

It has been reported that thyroxin in proportion to its iodine content is not as active as thyroid extract. This evidence shows that the thyroid secretion is not thyroxin, but thyroglobulin. However, it might be pointed out that the thyroid may secrete both thyroxin and thyroglobulin. An alternate assumption might be made, namely, that thyroglobulin is a compound of thyroxin and globulin, and that the globulin serves solely as a carrier of the thyroxin.

Does hyperplasia mean hypersecretion? It is well known that hyperplasia is present in the so-called toxic thyroid. So far as I am aware, one never sees a case of toxic thyroid in the absence of some hyperplasia. However, hyperplasia can occur without the presence of any symptoms of a toxic thyroid.

It is possible in a number of different ways to produce hyperplasia of the thyroid experimentally, but no one has successfully shown that the symptoms of toxic thyroid have been produced in such experiments. The feeding of large quantities of thyroid extract to animals and to man produces most of the symptoms of toxic thyroid, except exophthalmos. The failure of animals below man to develop exophthalmos may be a species difference, and the development of exophthalmos in man, in those cases in which it does occur, may be due to an individual susceptibility to some secondary effect of the thyroid disturbance or of the etiological agents causing the thyroid disturbance.

It should be pointed out that an increase in cells does not necessarily mean a biological or physiological increase in the output of secretion. An increase in secretory cells means an increase only in capacity to secrete.

In the Mobius theory it is maintained that hyperplasia means hypersecretion. This theory is supported by the following observations: (1) Feeding thyroid to normal individuals produces many of the symptoms. (2) Patients with toxic thyroid are very susceptible to thyroid feeding. (3) The removal of a large part of the thyroid gland relieves the condition temporarily and in some cases permanently. The evidence purporting to show an increase in the secretion of the thyroid in "toxic thyroid" is at present incomplete and unsatisfactory.

In the perverted secretion theory it is maintained that the hyperplastic gland produces an abnormal, perverted, or toxic secretion. There is no good evidence supporting this theory. The hypothetical contention is made that the cells of the hyperplastic gland are embryonic in type and hence cannot form a normal secretion. However, it might be pointed out that the hyperplastic gland in many respects is histologically not unlike the gland of the fetus and pre-adolescent child.

In the compensatory hypertrophy theory it is maintained that some unknown etiological agent increases the need of the body for the thyroid secretion and the hyperplasia occurs as a biological response on the part of the thyroid gland to meet this need. The toxic symptoms may be due to over-compensation with increased output of secretion, etc. This theory is supported by the observation that in a few cases of toxic thyroid, symptoms of hypothyroidism are manifested.

At this point, I should like to point out that removal of the thyroid by surgery, x-ray, coagulation, etc., does not strike at the fundamental etiology of the disease. Only an important manifestation of the disease is attacked.

Does the thyroid gland receive specific secretory nerves? We know that nerves enter the thyroid gland and have an intimate relationship with the blood vessels and cells of the gland. That many of these nerves are vasomotor can be easily demonstrated but whether any of them control the secretion of the gland is a mooted question.

What is the rôle of iodine? Iodine is an important chemical constituent of the thyroid, much more of it being found there than in any other tissue. There is a direct relationship between the iodine content of the thyroid and its histological structure. There is little or no iodine in the hyperplastic gland, and colloid is likewise absent. As colloid appears in the gland, the iodine content increases. Since no iodine has been found in the thyroids of some normal adults, it has been argued that although iodine plays an important rôle in the activity of the thyroid, its presence is not essential. It has been shown by experiment that the activity of thyroid extract is proportional to the iodine content. Marine found that the administration of iodine

causes a hyperplastic gland to revert to the colloid type and is an important prophylactic agent against endemic goiter. Recently, Oswald has come to the conclusion that iodine deficiency does not have any direct etiologic relationship to endemic goiter, and other writers have stated that goiter has increased in spite of the use of iodine as a prophylactic agent. On the other hand there are statistical reports showing that iodine in "proper dosage" markedly decreases the incidence of endemic goiter.

At present the mode of action of iodine is unknown; its use is empiric. There is much evidence to show that iodine activates the secretion of the thyroid. Some investigators believe that it plays an important rôle in metabolism and compare it to iron, stating that the thyroid exercises a conservation over the iodine supply of the body just as the liver does over iron. It is true that if iodine is administered, a relatively large percent of it can be recovered from the thyroid. Some investigators believe that the thyroid protects the body against the toxic action of iodine by removing it from the circulation, rendering it non-toxic, and slowly throwing it off into the circulation in non-toxic doses for elimination.

At the present time, iodine is being used widely in the treatment of "toxic thyroid." It has been found to be of marked benefit when it is first administered, but its continued administration does not prevent a recurrence of the disease. How it exercises a beneficial action when first administered is not clearly understood. It has been reported that its administration causes certain cells in the thyroid to degenerate and that other cells are not affected. If the toxic symptoms were due to the cells which the iodine administration causes to degenerate, then we should not expect the disease to recur. If the toxic symptoms were due to the iodine-resistant cells, then the first administration of iodine should have been of no benefit. If toxic thyroid were due to iodine deficiency, we would expect the disease to be cured by iodine administration, just as iron is curative in secondary anæmia, or as vitamine D is curative in rickets.

Two explanations have occurred to me with regard to the therapeutic results of iodine administration in toxic thyroid. The first is that iodine acts as a drug, depressing the activity of the thyroid or the symptoms of toxic thyroid, and that the disease recurs because a tolerance to iodine is established. If this theory is true, one might expect a good effect when the disease recurs on definitely increasing the dose. The second explanation is based on the observation that following iodine administration, when the thyroid gland is hyperplastic, the iodine is passed into the acini and some colloid is formed. It is possible that the administration of iodine to a patient with "toxic thyroid," suddenly causes the thyroid gland to stop secreting into the blood and causes it to store its secretion in the acini. After a period of time, however, the demand or need of the body for the secretion becomes so great as to overcome the tendency of the iodine to cause the cells to store their secretion.

It is obvious that in spite of the many advances that have been made in our knowledge of the physiology of the thyroid gland, we are still unable to state positively what causes the physiological disturbances manifested in cases of toxic thyroid. Although we are quite certain that the thyroid is in some way concerned with the production of the symptoms, its specific rôle has not been determined. The present treatments are empiric, but, in my opinion, this fact does not condemn their use.

The problems on this question are numerous. I hope the workers may become as numerous and as inspired as the problems are complex and intriguing.

PATHOLOGICAL CONSIDERATIONS OF THE TOXIC THYROID

By JAMES PERSONS SIMONDS, Ph.D., M.D., Chicago

Professor of Pathology, Northwestern University Medical School

Dr. Ivy has presented the evidence for considering the thyroid gland as the organ involved in exophthalmic goiter. The very fact that some have questioned the causal relation between the changes in the thyroid and the manifestations of this disease indicates that there are other important pathological conditions present. In discussing the pathology of the toxic thyroid it is therefore necessary to consider the subject from a broader point of view than from that of the thyroid alone.

Changes in the thyroid gland are admittedly the most constant features in cases of thyrotoxicosis, but they are somewhat varied.

To appreciate fully the changes in the thyroid which are commonly associated with this condition it is necessary to bear in mind the normal histology of the thyroid gland. It is composed essentially of spaces called acini which vary in size, but have the common characteristics of being filled with a colloid material and being lined by a single layer of low cuboidal epithelium. In the type of simple goiter not associated with toxic symptoms there is an increase in the size of the acini and in the amount of colloid which they contain, and the epithelium lining the acini becomes flatter in shape.

The changes in the thyroid gland associated with toxic symptoms present four fundamental characteristics which may be present in varying quantitative relations. The first change to be mentioned occurs in the epithelium lining the acini. There is a change from low cuboidal to high columnar cells, the nucleus is located at the base of the cell; and the cytoplasm is pale and non-granular. This is a distinct alteration of the normal epithelium. A second change occurs in the colloid content of the acini. In the normal thyroid each acinus contains a considerable amount of colloid material which, by its staining reactions and other characteristics, gives the appearance of being rather firm in character. In cases of thyrotoxicosis this colloid is markedly reduced in quantity and definitely altered in quality. It gives the appearance of being rather thin and somewhat watery, and does not take ordinary stains as deeply as that in the normal gland or in cases of simple goiter. A third type of change in toxic thyroids is the presence of areas of lymphocytic infiltration. This may consist of localized areas of infiltration in which the lymphocytes may be somewhat loosely scattered in the connective tissue, or more densely crowded together, even to the extent of forming definite lymph follicles with germinal centers. A fourth type of change which is encountered in toxic thyroids is the presence of so-called adenomata.

These four types of changes, namely, increase in the height of the epithelium, diminution in quantity and alteration in quality of the colloid, lymphocytic infiltration and circumscribed or diffuse adenomatous growths make up the histopathologic elements out of which a microscopic picture of toxic thyroids is constructed.

The two main clinical types of thyrotoxicosis are exophthalmic goiter and adenomatous goiter. In the case of exophthalmic goiter the histologic picture shows acini lined by tall columnar epithelium and containing colloid which is relatively reduced in quantity, and definitely thinner and less dense than normal colloid. In addition to the change in character of the epithelium there occurs an invagination of the walls of the acini giving rise to what appear to be papillary ingrowths covered with the altered tall columnar epithelium. This invagination is a very important element in the pathology of exophthalmic goiter in that it enormously increases the actual secretory surface of each acinus. Thus there is a histologic basis for the alleged hyperthyroidism of exophthalmic goiter in this increase of secretory surface. There is also suggestive evidence of an altered secretion, the so-called dysthyroidism, in the change in character of the lining epithelium and of the contained colloid. The lymphocytic infiltration, which is an almost constant finding in exophthalmic goiter, is also believed to be indicative of the toxic character of the thyroid secretion, inasmuch as lymphocytes tend to accumulate in areas in which a mild toxin is operating. Thus, it is seen that in exophthalmic goiter three fundamental pathological changes are found in varying combinations.

The second clinical type, namely, the adenomatous goiter, appears in two forms, the fetal and the diffuse adenoma. The fetal adenoma consists of one or more rather sharply circumscribed and partially encapsulated, soft, reddish-gray growths composed of very small acini lined with cuboidal or low columnar epithelium and usually devoid of colloid. The stroma between these acini is frequently hyaline. This type of adenoma gives rise to markedly toxic symptoms which differ in certain essential respects from those of exophthalmic goiter so that the two conditions can be differentiated clinically.

The diffuse adenoma is characterized by the presence of multiple nodular growths in the thyroid, and does not differ greatly from simple hyperplasia of the gland. The glands contain more colloid and are less characteristic and distinctive histologically than the fetal type. They do not usually give rise to very severe toxic symptoms.

In other cases of thyrotoxicosis the thyroid does not differ materially from the normal. There may be cases in which an undiscovered fetal adenoma was the cause of the symptoms; or there may be instances in which a change in function is not accompanied by a correspondingly obvious change in structure. Goetsch has reported an increase in the mitochondria in the epithelial cells in these cases and insists that this indicates an increase in function. Other investigators have contended that the number of mitochondria is related to the size of the cells rather than to the degree of function.

As already stated the thyroid gland is not the only organ which shows pathologic changes in cases of toxic goiter. In about 75 per cent of all cases of exophthalmic goiter there is an increase in the size of the thymus gland. The exact relationship of this to the disease is not clear. That it may be concerned in the production of the symptoms is suggested by the fact that removal of the thymus gland without operating on the thyroid, or reducing the size of the thymus gland by treatment with x-ray, frequently results in improvement in the clinical symptoms of the disease. This enlargement of the thymus in cases of exophthalmic goiter does not appear to be a part of the condition of status thymicolymphaticus.

The cervical lymph glands are usually more or less enlarged in cases of exophthalmic goiter. This is believed to be due to the absorption of toxic material from the thyroid into the lymphaticus which, upon reaching the glands, causes a hyperplasia of the lymphoid tissue. This change is in keeping with the lymphocytic infiltration of the thyroid gland itself in exophthalmic goiter.

Leslie B. Wilson and his co-workers first called attention to a certain change found in the cervical sympathetic ganglia. This change, characterized by the presence in the ganglion cells of a brown pigment, has apparently not been found in conditions other than that of exophthalmic goiter. This finding of Wilson is rather in keeping with Cannon's view that in exophthalmic goiter there is an over-stimulation of the thyroid gland, at least in part, by way of the sympathetic nervous system.

One of the most important effects of exophthalmic goiter is that upon the heart. The increased heart rate characteristic of thyrotoxicosis must place an extra burden upon the heart, but the amount of hypertrophy which occurs in these conditions is usually high. Nevertheless, in many cases there is little clinical evidence of hypertrophy, because of the marked increase in metabolism which prevents hypertrophy of the heart muscle. However, decomposition of the heart may occur. Frequently there is little gross evidence of pathologic change. Microscopically there may be found disseminated areas of focal necrosis of the heart muscle or small areas of fibrosis. The latter may result from replacement of the necrotic areas by fibrous tissue. Nevertheless, the cardiac decompensations which occur in exophthalmic goiter cannot be fully explained by the gross and microscopic changes found in the heart at autopsy. It is possible that the markedly increased metabolism of this disease renders it impossible for the heart to maintain its proper nutrition so that the decompensation may be, at least in part, a result of insufficient nutrition of a heart muscle which is contracting at a markedly increased rate. Decompensation of the heart may occur as a terminal condition in exophthalmic goiter and it may be associated with the usual symptoms, such as passive hyperæmia of the lungs and liver, œdema, and even occasionally venous thrombosis in different parts of the body.

THE SURGICAL TREATMENT OF TOXIC GOITER

By HARRY M. RICHTER, M.D., Chicago

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Studies of thyrotoxicosis have failed to reveal any essential etiological factor for this disease outside of the thyroid gland itself. That the thyroid gland is essential to the existence of the disease has also been amply demonstrated. The evidence may be summed up as follows:

1. Practically every phase of thyrotoxicosis has been reproduced in the experimental laboratory by feeding thyroid to healthy, normal animals.

2. The essential features of the disease have been reproduced in healthy human beings in the same manner.

3. Hyperthyroidism has been substituted for postoperative hypothyroidism in the same manner.

4. The thyrotoxicosis can be consistently removed by adequate removal of the thyroid, and normal function or hypothyroidism as consistently substituted.

These findings have constituted the basis for surgical therapy.

Irrespective of what the etiological factor may ultimately prove to be it has been found that the presence of the thyroid is essential to the continuance of thyrotoxicosis, while adequate removal of the gland is incompatible with the continuation of the disease. Furthermore, there are no exceptions to this rule, and failure to accomplish complete removal of the thyrotoxicosis by thyroidectomy is absolute evidence (to which there is no exception) that an amount of pathological thyroid sufficient to continue the symptoms has been left behind. Actual clinical results of thyroidectomy on human beings constitute the basis for these statements.

For the purpose of comparing the condition of the patient after operation, with the pre-operative condition, and also for the comparison of the results of surgical treatment with that of other methods of treatment, one must establish a common basis from which to start. Since "impressions" of the results of treatment by various methods are likely to be affected by bias, they are usually misleading. Hence, one must compare only those results which are manifest by objective phenomena that can be definitely estimated and registered. Several such factors which are useful are gain in weight, pulse rate, physical capacity, etc. For the purpose of this paper I wish to use as the basis of comparison of results, a study of the basal metabolism, not with any thought that it should take the place of an adequate clinical study, but because it offers the best possible means of eliminating the personal equation. It is equally valuable in studying the effect of the operation on the patient, and in comparing the results obtained by the different methods of treatment.

This report is based on two groups of "consecutive" patients, i.e., every patient whose consent could be obtained was operated upon. The first group consists of 112 thyrotoxic patients, adequate follow-up metabolism study being obtained in 100

instances. In 94 of these 100 cases the basal metabolism rate was found to be reduced to plus 15 or below. Of the six patients whose metabolic rate remained above plus 15 following thyroidectomy, five consented to a second operation, and in each case the metabolic rate was then reduced to below plus 15. Thus in 99 of the 100 consecutive patients who could be personally followed, the metabolic rate was reduced from an average of plus 50.5 to an average of plus 1.8. In all 99 the rate was reduced to plus 15 or below. Though a number of these patients were organically damaged by the long-continued pre-operative thyrotoxicosis, none had any residual thyrotoxicosis following operation. The one-hundredth patient refused to submit to further study or re-operation.

The second group of patients upon whom this report is based consists of 500 consecutive thyrotoxic patients who submitted to thyroidectomy. In 460 of these patients a postoperative metabolic study was made under the same conditions as those of the first series, that is, all were supervised personally, except a few who were under the observation of competent internists in Chicago. The pre-operative metabolic rate of these patients averaged approximately plus 45. Of the 460 patients studied postoperatively 444 showed a metabolic rate reduced to or below plus 15. Of the sixteen whose metabolic rate remained above plus 15, ten showed a rate of between plus 16 and plus 19, two of these estimations being made on the sixth and ninth postoperative days. On the basis of this metabolic study, it was found that in six of the 460 patients who were adequately studied, the metabolic rate remained substantially above normal. With our previous experience as a basis we can say without hesitancy that in these six cases an inadequate amount of thyroid was removed, that sufficient thyroid tissue remains to maintain the residual hyperthyroidism, and that if re-operation is submitted to the metabolic rate will be reduced to normal.

It seems to me that the consistent effect of thyroidectomy on the basal metabolism of the patient amounts to the equivalent of a laboratory experiment based on a substantial series of experiments on human beings. We can definitely say that in hyperthyroidism an adequate thyroidectomy will lower the metabolic rate to normal and if it fails to do so an opportunity for re-operation will demonstrate that the source of failure lies in the inadequacy of the operation.

All of the patients whom I included in this study showed definite hyperthyroidism prior to operation. Few were included whose pre-operative metabolic rate was below plus 30. The rate in some cases was as high as plus 128. The ages ranged from fourteen to seventy-seven years. The average time required following operation for the metabolism to reach normal cannot be stated, since in many cases the first postoperative metabolism test was given anywhere from four to six weeks after operation. However, a similar study conducted at the Massachusetts General Hospital demonstrated that the intoxication as measured by the drop in metabolism was controlled in an average of ten days; a remarkably quick result, when compared with the months of treatment required by radiotherapy and other non-surgical methods. To obtain these operative results the incidence of damage and the mortality compare favorably with those of any major operative work. The mortality has been consistently well under 1 per cent. There has been but one death in the last 600 consecutive patients subjected to operation.

THE SURGICAL TREATMENT OF TOXIC GOITER

By ALLEN B. KANAVEL, Sc.D., M.D., Chicago

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There is no surgical lesion in which greater care is necessary in the pre-operative treatment and the operative procedure than in toxic goiter. In the early years of our experience, before the introduction of Lugol's solution and maximum thyroidectomy, the mortality rate was probably in the neighborhood of from 6 to 10 per cent. The operation was approached with great fear and where it could be avoided, it was deemed a part of wisdom to be conservative. As the years passed, however, and we proceeded from unilateral lobectomy to subtotal thyroidectomy, ligation of the poles, and treatment with radium and x-ray, an accumulated knowledge was acquired by the surgical profession as to the proper methods of surgical approach and the proper type of pre-operative treatment, so that now in our last hundred cases of toxic goiter, some of them being of the gravest type both as to toxicity and cardiac impairment, there has been but one death. We view operation in these cases with no more concern than we do operation in cases of interval appendicitis, or the quiescent gall-bladder. Indeed the convalescence in most of the cases of toxic goiter is much smoother.

Our present technique in the care of these patients is as follows:

Preparation of the patient. The patient is placed in bed for from ten days to two weeks before operation and is given 10 drops of Lugol's solution three times a day. Not infrequently digitalis is resorted to if there is a marked cardiac incompetency. The length of time the patient is to be kept in bed is determined by the change in weight, the reduction of the metabolic rate, and the clinical evidences of restoration to normal nervous balance. Every endeavor is made to reassure the patient as to the ultimate outcome. A high carbohydrate diet is given, the carbohydrates being pushed in the form of glucose candy; meats are entirely eliminated.

During this period a careful systemic examination is made and any complicating factors are treated. We investigate especially as to the possibility of parathyroid insufficiency and if this is found calcium is administered as the condition may demand. The vocal cords are always examined, since we have found in several instances that a paralysis of one cord was present before operation. This not only protects us against an improper judgment as to the result of operation, but also puts us on our guard during operation to avoid the possibility of further injury. If the glands are found to be retrosternal, we make our incision lower down in the neck; hence it is essential that we know the general relations of the thyroid before operation is performed. There is a considerable group of patients who have suffered for a number of years with adenoma and hence have excessively large veins. This condition is anticipated and especial care taken to ligate every possible bleeding point. We also note it since we wish to have the blood typed and a donor ready in case hæmorrhage is excessive.

The judgment as to the proper time of operation depends so much upon clinical experience and a careful evaluation of the patient's condition that I would do less than justice did I not speak especially of the great service we have obtained from the medical division of Wesley Hospital under the supervision of Dr. Charles Elliott. I have spoken of the routine preparation of these patients, and I will leave it to Dr. Elliott to discuss the atypical group in which large amounts of Lugol's solution and prolonged care in the hospital may be necessary as an incident to cardiac incompetence.

When it is judged that the patient's condition is such as to permit operation, $\frac{1}{150}$ grain of scopolamin, and $\frac{1}{4}$ grain of morphine are given in addition to the usual preparation in all operative cases. On the operating table the field of operation is anæsthetized with $\frac{1}{2}$ per cent novocain without adrenalin. We first insert 30 cubic centimeters on each side at the level and just in front of the fourth transverse cervical process, being certain before administering the novocain that the needle is not in a vein. Theoretically, this should give complete anæsthesia to the field, particularly if, when the needle is withdrawn, some novocain is injected along the posterior surface of the sternocleidomastoid muscle. However, since not infrequently the anæsthesia is incomplete, we make it a routine measure to inject underneath the skin along the line of incision and later when the muscles are exposed novocain is injected into the muscles and again if necessary some is injected around each superior pole. By this method we have operated on well over 200 cases with remarkably few instances in which it was necessary to administer nitrous oxide as an adjuvant. Where this is necessary, however, we do not hesitate to use it.

After the field has been prepared and the novocain injected, we first gain the confidence of the patient by drawing the blunt end of the knife across the skin; we then make our incision transversely about an inch above the sternal notch. The skin is undercut and elevated to the thyroid and down to the sternum. All large bleeding points are now ligated. An incision is made down to the capsule of the thyroid between the thyroid muscles. We now dislocate one lobe. We are careful to insist upon this point since we have at times been under the impression that the elevation of both lobes tended to produce a partial paralysis of the vocal cords. Indeed, throughout the operation, if, when we are pulling on the gland, the patient shows any evidence of impairment of breathing, we immediately lessen the tension. The lobe is elevated with a tongue forceps, and we remain within the capsule of the gland cutting any small veins that may pass from the thyroid to the capsule, and continue the separation until the trachea can be seen and felt. The upper pole is freed and cut off between forceps. The upper portion of the thyroid is then freed and elevated, thus assisting in the dislocation of the thyroid from beneath the sternum. If there is a large amount of retrosternal thyroid we begin the severence of the gland from the posterior capsule from above downward without attempting to dislocate the lower pole, and when the gland is detached the retrosternal thyroid lobe will come up without the slightest difficulty. If, however, there is no difficulty in reaching the lower pole, forceps are clamped along the posterior surface of the lower pole, care being taken to place the forceps so as to cut into the gland and avoid possible injury to the parathyroids and recurrent laryngeal. Forceps are now attached around the periphery of the posterior capsule and across the isthmus, and

the lobe is removed so as to leave behind not more than 1 gram of thyroid. Indeed our idea is to remove as much of the thyroid as we can without running the danger of injuring the recurrent laryngeal. Probably the entire amount left on either side is no larger than a bean. After the lobe has been detached we now remove the other lobe and isthmus in the same manner. In most instances it will not be found necessary to insert drainage, but if there is any oozing of blood or if there is a large retrosternal cavity left after the removal of a retrosternal thyroid, or if we have been compelled to be content with less than this maximum thyroidectomy, a rubber drain is inserted for from twelve to twenty-four hours.

In our earlier cases we were inclined to remove adenomata by pealing them out, but it happened so frequently that small adenomata which were left gave rise later to symptoms, that now in practically all such cases we do the maximum thyroidectomy as described.

Among the complications and accidents that may occur, three are outstanding—hæmorrhage, injury to the recurrent laryngeal, and injury to the parathyroid. Hæmorrhage may occur either at the time of operation or subsequently. Experience has convinced us that it should be a very infrequent complication at the time of operation if the gland is elevated, if the capsule is detached properly, as has been described, and if the maximum thyroidectomy is done. A few years ago when we were doing the so-called subtotal thyroidectomy we not infrequently had considerable hæmorrhage from the cut surface of the thyroid. Since in many of the older patients the vessels are so friable that the ligatures cut through with ease, we, therefore, make it a point to place a double ligature on the superior pole and ligate all small bleeding points about the remnant of the capsule. In one case a number of years ago, before we learned the technique of excising the retrosternal thyroid from the upper pole downward, we had a very severe hæmorrhage from some deep lying vein in the chest. Fortunately we were able to clamp it with forceps. The next day the arm was swollen to twice its normal size, but after a week or two collateral circulation was established and no untoward effects ensued. At another time an assistant inadvertently clamped a toothed forceps on the jugular vein. A lateral ligature here, however, was done without difficulty. In possibly a half dozen instances we have had hæmorrhage occur in from one to four days after the operation probably as the result of the slipping of some ligature. Here we have not depended on packing but have opened the wound, sought the bleeding point, and tied it or covered the area with a running suture. In two instances we have seen in consultation patients who had a secondary hæmorrhage in from two to three weeks after operation in infected wounds. Here we have also advised immediate opening of the wound and suturing of the entire bleeding area with running sutures rather than run the risk of repeated secondary hæmorrhages. In both of these instances this procedure was successful. At times when opening the wound in patients who have had a hæmorrhage a day or two after operation one is unable to find any large bleeding point, there apparently being an oozing from over a considerable area. In these cases the hæmorrhage has been controlled by the local application of coagulose.

Injury to the recurrent laryngeal nerve probably occurs more often than the average surgeon believes, since a slight hoarseness is often considered to be an evidence of pharyngitis rather than a partial paralysis. We have been careful during

the last few years to examine the vocal cords before operations in all cases and where there is any degree of postoperative hoarseness examination is also made by the laryngoscopist. Injury may be of any degree ranging from simple trauma, ligature of the nerve, or severance of the nerve. A partial injury may be engendered by pressure incident to raising both lobes at the same time or due to trauma sustained during manipulation of the gland. In these cases the cords may be found closely approximated and the patient shows marked cyanosis with difficulty in breathing. At the slightest evidence of this the gland should be replaced in its normal position and if the symptoms persist an immediate tracheotomy may be indicated. The surgeon should always be prepared for this emergency. One of the great advantages of local anæsthesia lies in the fact that when the surgeon is working in the field of danger he can keep the patient talking and thus know when he has clamped or traumatized the nerve. I have repeatedly caused small injuries to the nerve, but know of no case in which I have severed the nerve.

The injury of the parathyroids is a subject of considerable interest. In our preliminary examination before operation it is surprising how frequently patients will be found who have a partial parathyroid deficiency with Chvostek's and Trousseau's sign. After operation it has been our experience that it is present in possibly 5 to 8 per cent of the patients. These patients are immediately given calcium and in every case the evidence of such deficiency has disappeared in from three days to a month. That complete parathyroid deficiency does occur is a well established fact.

In one patient we inadvertently made a small opening into the trachea, but this was sutured without complications. We have also been fortunate in not having had a single case of collapse of the trachea due to absorption of cartilage.

After-treatment. The patients are dressed with a compression bandage so arranged as to produce pressure at the site of removal of the lobes. They are placed in bed in a semi-sitting position and kept at absolute rest. Tap water is given by rectum and to the first pint is added 60 drops of Lugol's solution. Later in the day 15 drops are given at two periods. The second day after operation 20 drops of Lugol's solution are given three times a day and the amount is gradually reduced in the succeeding days until at the end of a week or ten days its administration is stopped. Sedatives are given as required—morphine, scopolamin, or sodium bromide. Particular attention is paid to the administration of water, and it is given by rectum until the patient takes it freely by mouth. At least 3000 cubic centimeters of water is given every twenty-four hours. Cardiac stimulation is seldom resorted to, but when it is necessary it is generally given in the form of digifolin to those patients who before operation have had incompetency of the heart. It does not seem to be of any value in slowing the rapid pulse.

Complications must be met as they arise. Since the introduction of Lugol's solution in the treatment of these patients both before and after operation, and the development of the operative procedure to the stage of a maximum thyroidectomy, hyperpyrexia is seldom seen although formerly it was a serious menace. In fact, our records do not show a single case of marked hyperpyrexia since the introduction of these changes in our technique. When it does occur the patient should be sponged, or packed in ice immediately, care being taken to remove the ice before the patient's temperature reaches normal.

With the maximum thyroidectomy a slight degree of hypothyroidism is probably present in a fair proportion of the cases. Not infrequently there is a metabolic rate of minus 20 for from two to five weeks after operation and at times we have thought it advisable to administer thyroid extract temporarily because of vague distress in the legs or some other such complaint. In no case has it been necessary to continue the administration of the extract after two months.

An experience covering twenty-five years has permitted us to view the evolution of the surgical treatment of the toxic thyroid, and it is a pleasure to record that now at the end of that period surgeons have developed a procedure that presents a minimum of danger and an almost certain guaranty of restoration to clinical well being. To be sure it cannot be claimed that we have removed the cause and to that extent the treatment must be considered inadequate, but these patients undoubtedly can be restored to health and can become normal working members of society. The results of ligation, partial thyroidectomy, x-ray or radium treatment, and injections of boiling water, in no way compare with the results obtained by maximum thyroidectomy. The toxic symptoms disappear immediately. The patients leave the hospital at the end of ten days stating that they feel entirely well. They gain from 10 to 25 pounds in weight within a month and have a sense of well being that most of them have not experienced for years. Although in a critical medical investigation in many cases some slight evidences of hypothyroidism, or the residual signs of the toxæmia that has been present for so long on the part of the eyes, the nervous system, and the heart may be found, yet such a large proportion of the patients claim that they are well that it is difficult for the surgeon to believe that any other method of treatment is justified in the present state of our knowledge. It is true that in the old toxic cases with marked exophthalmos this sign seldom disappears.

Dr. Charles Elliott has submitted the patients we have operated upon to an exceptionally critical medical examination, and has reported the results of that examination. For the sake of fairness, however, I should draw your attention to the fact that the physician may be able to ascertain by questioning and examination evidences of disease of which the patient in a clinical sense may be entirely unaware. I would differentiate therefore between the results of the careful scientific examination and the ordinary clinical observation. This is not said in any sense to criticize or to minimize such examinations, but to draw your attention to the fact that a patient may be clinically well to all ordinary observation and his personal feeling, and may live out the natural span of his life, while at the same time critical investigation may reveal evidences of a previous disease.

In several instances we have been called upon to operate upon patients who have at some previous time had unilateral lobectomies or subtotal thyroidectomies because they were not entirely well. From a technical standpoint the excision of such remnants may be difficult. We have found, however, that it may be done with entire safety. The remnants are more easily removed if we approach the gland from its lateral side, exposing and freeing the remnant underneath the sternocleidomastoid muscle, elevating it, clamping the vessels, and then passing to the anterior and medial surface.

It has also seemed unwise to differentiate between exophthalmic and adenomatous goiter in this discussion. In the former special attention must be paid to the toxic symptom and in the latter to the state of the heart before and during the operation.

PARATHYREOPRIVE TETANY

By WILLIAM H. HOLMES, M.D., Chicago

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The symptoms of parathyreoprive tetany include changes in sensory, emotional, mental and motor states. The motor symptoms are neither the first to appear nor the most marked, although they are the most easily recognized. In every case of tetany which I have observed, subjective sensory symptoms have preceded the appearance of the objective motor signs. The sensory disturbances include tingling and numbness of the fingers, itching of the skin, burning sensations, cramp-like pain in the legs, and a burning sensation in the epigastrium. The emotional changes consist of depression, apprehensiveness, but particularly of an increased irritability. The mental symptoms consist of periods of amnesia, loss of consciousness, and delirium. Hjort and Eder (2) report a case of tetany in which two attacks of maniacal excitement occurred. Other authors have commented on the occurrence of sensory, mental and emotional changes in tetany, but so much emphasis has been placed on the motor signs that the importance of other symptoms is often overlooked. The hyperexcitability of the nervous system in tetany extends to and includes the sympathetic system as indicated by the occurrence of flushing, sweating, vomiting, diarrhœa, and tachycardia, and by changes in the respiratory rate. Unless accompanied by the motor signs of the disease the subjective sensory and emotional changes may lead to confusion with the psychoneuroses. The true nature of the symptoms should be recognized when they follow a thyroidectomy.

The motor signs of tetany consist of a simple increase in muscle tone, of an increased reflex excitability, of bilateral tonic spasms, and of general convulsions. The spasm of tetany develops slowly during a period of several seconds. It lasts from one to several minutes, is accompanied by severe pain and disappears as slowly as it came. The pain accompanying the spasm may be so great that the patient cries out and he usually lives in dread of a recurrence. Between the attacks of spasm there may be rigidity of the muscles, which can be observed when the patient attempts to walk or to perform fine movements. In one of my cases in which spasm had been controlled by appropriate treatment, the persistence of muscular rigidity led to a diagnosis of postencephalitic rigidity by a competent observer. As has already been remarked, the spasm is tonic in type and when it occurs with an external stimulus it is bilateral. It involves principally the more distal flexor muscles of the extremities, giving rise to the so-called carpopedal spasm of tetany. In spasm of the hand the fingers are held in a position which somewhat resembles the normal position for holding a pen or pencil except that the thumb is flexed and more adducted. In a severe spasm the hand is flexed on the wrist and the forearm on the arm, the arms being crossed in front of the chest. Spasm of the feet is characterized by inversion, adduction and plantar flexion of the toes. The attacks of spasm are usually confined to the hands and feet. Facial grimacing, laryngeal spasm or

abdominal muscle spasm may be observed occasionally in severe cases. Attacks may follow one another at short intervals, they may occur only once or twice daily, or they may require some special stimulus to induce them, depending on the severity of the illness. The general convulsion of tetany is distinguished from that of epilepsy by the absence of clonic movements, by the history, and by the association with other clinical signs of the disease.

In manifest tetany the signs are so typical that diagnostic tests are unnecessary. In latent tetany, spasm may be induced either by mechanical, chemical, electrical or sensory stimulation. Trousseau's sign consists of the induction of spasm by pressure either on the vessels or nerves of the arm. Spasm of the face following a sharp tap over the malar bone or over the trunk of the facial nerve constitutes Chvostek's sign. Erb's sign consists of an extreme degree of galvanic excitability of the motor nerves so that cathodal closing tetany is produced by an amount of current which in a normal person would produce only a simple contraction. Firm pressure on a purely sensory nerve, such as the supra-orbital, may also produce spasm. As pointed out by Grant and Goldman bilateral spasm may be induced by changing the hydrogen ion concentration of the blood by pulmonary over-ventilation. The effect is produced by the too rapid loss of carbon dioxide. A similar result may be obtained by the administration of sodium bicarbonate.

Mention of the pathogenesis of tetany requires some discussion of forms which are not caused by removal of the parathyroid glands. One of the best known forms is that which occurs in rachitic infants fed on cow's milk. John Howland (3) in his review of the subject of rickets says, "Marriott and I first studied tetany in a long series of observations and were able to show that, with the symptoms of the so-called idiopathic form of infancy, a marked reduction of the calcium of the serum can be determined. From a normal level of 10 to 11 milligrams per 100 cubic centimeters of serum the calcium may sink to a level of 7 or even 5 milligrams." The serum calcium concentration in rickets uncomplicated by tetany may be normal or slightly reduced. Marked rachitic deformities may exist without demonstrable change in the calcium concentration. Calcium and phosphorus cannot be considered independently of each other. Howland found that the average decrease in calcium concentration in a series of seventy-two cases of rickets was only 5 per cent, while the reduction in the inorganic phosphorus was over 50 per cent. The findings of Howland showing a low blood calcium in infantile tetany were confirmatory of the findings of W. G. MacCallum and others. Under normal conditions a balance is established between the concentration of calcium and phosphorus in the serum. Experiments indicate that an increase in the phosphate ion will decrease the available calcium ion unless there is also an increase at the same time of hydrogen ions.

Gastric tetany due to pyloric obstruction appears to be due to a loss of hydrochloric acid through vomiting, although it may be due to calcium starvation dehydration, intoxication or alkalosis. In gastric tetany the calcium concentration may be normal, but both the phosphorus and the alkali reserve of the blood are increased. Thus it would seem possible to produce tetany either by the injection of sufficient alkali or the injection of phosphates irrespective of the absolute amount of calcium. Experiments indicate that such is the case.

It has been observed that the injection of guanidin, methylguanidin and various

poisonous amines produces symptoms identical with true tetany. On the basis of these observations there are many who believe that tetany is the result of failure of the parathyroids to act as part of a detoxicating system which includes the liver. Bayer (1), however, has shown that guanidin injections lower the blood calcium and Nelken (4) has shown that while guanidin may or may not lower the calcium it usually increases the phosphorus. Dragstedt is convinced that tetany is due to a poison which originates in the gastro-intestinal tract through the activity of proteolytic bacteria. Dragstedt, Luckhardt and others, on the basis of this belief, devised a method for the removal of the supposed toxin by the introduction of large amounts of Ringer's solution. It was found that parathyroidectomized animals could be freed of the signs of tetany by this method without the use of calcium. This, however, does not prove that tetany did not develop because a toxin was washed out. It may have been, as remarked by MacCallum, that the diuresis removed an excess of phosphates. Dogs suffering from tetany, if kept alive for some weeks with calcium, gradually adapt themselves to a lower requirement of calcium. Symptoms may not appear even though the blood calcium falls far below the normal level. However, tetany can be produced in these parathyroidectomized animals if they are fed meat, but an increased amount of calcium serves to protect animals which are given large amounts of meat. It is natural that the absorption of toxins should be considered seriously as an explanation of tetany since it is so frequently seen as a complication of such a digestive disorder as diarrhœa. Here again other explanations are possible. Calcium is absorbed in the ileum and fæcal calcium is excreted by the colon. It is, therefore, possible that tetany as a result of diarrhœa occurs either because of inadequate absorption by the ileum or because of abnormal excretion by the colon. Howland, referring to the concentration of calcium and phosphorus in rickets, says: "The present evidence is all in favor of the view that defective absorption is the important factor. With a diet of cow's milk, the food which most children who become rachitic are receiving, the absorption and retention of mineral elements is less than with mother's milk even though the total intake is much higher with the former than with the latter."

It seems at present that all forms of tetany are due to a disturbance in the calcium-phosphorus balance. The balance between these two minerals may be disturbed by a variety of factors among which are (a) defective absorption of calcium due to disease of the gastro-intestinal tract, improper alimentation, lack of vitamins, or a reaction of the intestinal tract which favors precipitation of calcium; (b) excessive loss of calcium as in diarrhœa; (c) dehydration and disturbed salt balance as in vomiting; (d) alkalosis, whether produced by the injection of alkalies or by the too rapid loss of carbonic acid; (e) the absorption of toxins from the intestinal tract; and (f) injury or disease of the parathyroid glands.

The enormous literature on the subject of tetany is not a good index of its incidence, for following thyroidectomy the incidence of tetany is extremely low. Since 1910 there have been 1,072 thyroid operations performed in Wesley Memorial Hospital, of which 104 were partial, that is, right or left lobe lobectomies. Five cases of postoperative tetany are recorded, giving an incidence of 0.5 per cent. In 1914 only forty-seven thyroidectomies and seven lobectomies were performed, and one case of tetany developed. In 1926, 161 thyroidectomies and nine lobectomies were per-

formed, and one case of tetany developed. The incidence of tetany, therefore, has not increased, although the operation as performed today calls for removal of practically all of the thyroid tissue. The number of lobectomies is decreasing from year to year. The historian's records show that no lobectomy was performed during the first five months of this year. Ligation is resorted to but rarely. In addition to the five cases of tetany developing in patients operated upon at Wesley Memorial Hospital, four cases in which thyroidectomy was performed in other hospitals have been seen by me within the last three years. One of these cases occurred in a young woman following a lobectomy for a recurrent thyroid intoxication. The other lobe had been removed two years previously by another surgeon. Each surgeon removed one lobe of the thyroid in its capsule and of course removed the attached parathyroid glands also.

These figures refer only to cases of manifest tetany requiring active medical treatment. It must be admitted that temporary minor degrees of tetany may be observed following subtotal thyroidectomy in a much larger percentage of cases. In a series of 100 cases Richter (5) found some evidence of parathyroid injury in 14 per cent. The symptoms, however, are not obvious. A positive Chvostek or Trousseau sign usually constitutes the only objective evidence, and may last anywhere from a few days to several weeks. These minor degrees of tetany may be due to the removal of a single parathyroid gland, to œdema of the surrounding tissues, or to interference with the blood supply. Minor degrees of tetany observed immediately following subtotal thyroidectomy are of no clinical importance and are easily controlled. The experimental work on animals which shows that an adjustment can easily be made has been confirmed by surgical work on clinical cases.

Although the incidence of parathyroid tetany following subtotal thyroidectomy is low the possibility of its occurrence is constantly kept in mind in the pre-operative preparation of the patient. Protein in the diet is kept at the lowest possible point for two reasons. One reason is that protein has a high specific dynamic action, that is to say, the digestion, absorption and utilization of protein increases the rate of metabolism, an effect which is undesirable in the management of thyrotoxic cases in which metabolism is already in excess of normal. The other reason for withholding protein is in line with the observations of Salvesen, Luckhardt and others who observed that a high protein diet induces attacks of tetany in animals with a low blood calcium. We attempt to raise the blood calcium by the administration of calcium salts. It is impossible for the body to store excess amounts of calcium and so it is unnecessary to administer calcium salts for more than twenty-four to forty-eight hours before operation. The effect of giving calcium salts by mouth on the serum calcium will depend to a great extent on the method of administration. Roe and Kahn (6) have shown that small doses of calcium lactate in water, given during a fasting period, are more effective in raising the serum calcium than very large doses given with food. Five grams of calcium lactate in water given to a normal person before breakfast increased the blood calcium 50 per cent. Twenty grams of calcium lactate in milk when given to the same person increased the blood calcium 6.5 per cent. In a second subject 5 grams of calcium lactate in water increased the blood calcium 91 per cent while 55 grams of calcium lactate in milk increased the concentration only 28 per cent. Calcium salts are best administered in water early in the morning or late at night. Alkalies should not be given to a patient when the blood calcium is being raised. The absorbability of calcium

depends on its solubility, the latter being increased by acids and lowered by alkalies. The pancreatic, intestinal and biliary secretions are alkaline in reaction and in addition the bile contains fatty acids which can unite with calcium to form calcium soaps. It is probably due to these factors that calcium is less readily absorbed when given with food than if given during a postabsorptive state.

These very simple measures when supplemented with the administration of very large amounts of fluid successfully controlled the more severe objective signs of tetany which followed a subtotal thyroidectomy in a pregnant woman who was operated on in a local hospital two weeks before her admission to Wesley Memorial Hospital. It was impossible to reduce reflex excitability and general muscular hypertonicity to normal, and it was on this patient that a diagnosis of postencephalitic rigidity was made in a neighboring clinic. It is probable that had Collip's parathyroid extract been available at that time even better results would have been obtained.

Since the introduction of Collip's parathyroid extract in 1925, only three case reports of its application in parathyreoprive tetany have appeared in the literature. In two the results were very successful. In their report of the third case, Hjort and Eder state that "parathyroid extract given parenterally in large doses, from 20 to 130 units daily, had little, if any, favorable influence on the condition." As a result of their experience in the treatment of this case they conclude that:

> Every condition that might interfere with proper treatment should be corrected, such as facilitating calcium absorption by the administration of hydrochloric acid, when there is achlorhydria or hypochlorhydria, by the administration of thyroid substance when there is evidence of hypothyroidism, and by supplying an ample quantity of calcium, either by the addition of a liberal amount of milk to the diet or by the administration of calcium lactate in adequate doses. Desiccated parathyroid substance is not dependable, even when given in relatively enormous doses.

Our observations confirm the conclusions of Hjort and Eder.

In 1914 severe tetany followed a thyroidectomy performed by the late Dr. W. E. Schroeder. Desiccated parathyroid extract was without effect in controlling the spasm. It was felt at that time that the selection of glands might be faulty and that the method of manufacture might be responsible for the inefficacy of the product, but we have had similar experiences recently with products guaranteed to be made from parathyroid and not from lymphatic glands.

In the case of tetany following lobectomy already referred to, the attending physician has had great difficulty in controlling all the symptoms of tetany even with the use of Collip's parathyroid extract. It is unwise to give a good prognosis in a case where it appears probable that all of the parathyroid tissue has been removed. Although such an accident is not, as was once supposed, a fatal condition, it is not a condition which is easily controlled. Failure results in trophic changes in the hair, nails, skin, and the glands of the digestive tract. Changes in the cornea and lens capsule have also been observed. The object of treatment is to maintain the serum calcium constantly at or slightly above the normal level. Hypercalcæmia is to be avoided. The method of treatment can be summed up as follows:

1. Give calcium lactate by mouth in 5 gram doses in aqueous solution twice daily, on arising in the morning and just before retiring.

2. If this does not suffice to raise the blood calcium to 11 or 12 milligrams per 100

cubic centimeters of blood, the acidity of the gastro-intestinal tract should be increased. This may be accomplished by giving dilute hydrochloric acid if an achlorhydria exists and by encouraging the growth of aciduric organisms in the intestinal tract by the use of lactose.

3. The diet should contain a minimum amount of protein, phosphorus and fat. The diet should contain an abundant supply of vitamins.

4. The fluid intake should be increased to the highest possible point—3 to 4 liters daily.

5. Thyroid extract should be given in an amount sufficient to bring the rate of metabolism to normal.

6. If symptoms of tetany still exist Collip's parathormone should be given. The initial dose may be 20 units on alternative days. In the more severe cases this amount will be required daily. In Hjort's case 130 units daily was required to restore the normal calcium level.

7. Exposure of the body to direct sunlight is indicated.

Finally, transplantation of one or more glands should be considered. This has been performed successfully by Halsted and others. A transplantation was performed in 1914 by Dr. Schroeder in one of the cases referred to and since then the patient has been free from symptoms.

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THE TREATMENT OF HYPERTHYROIDISM

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A diversity of opinion exists as to the value of therapeutic agents which may be employed in the control of hyperthyroidism. Confusion of nomenclature and classification still further complicates the situation. There may be no misunderstanding as to the scope of the present study of the results of the control of hyperthyroidism, a statement as to classification and a brief mention of some clinical observations made on patients with hyperthyroidism may not be out of place.

In this study two clinical types of hyperthyroidism are recognized:

1. By *exophthalmic goiter,* also called primary or hyperplastic goiter, is meant a clinical type in which the onset of symptoms is rather sudden and occurs at a definite time, often following an acute infection; in which progression is accompanied by remissions; and in which the course is usually severe. In this type the thyroid gland seems to be stimulated to overactivity by some influence outside of itself, the exact nature of which is unknown. Histologically such a gland shows hyperplasia with colloid deposits, the amount of the latter apparently depending upon the completeness of iodine control. The generally accepted name, exophthalmic goiter, is misleading, in that exophthalmos is rarely an early manifestation.

2. By *toxic adenomatous goiter,* also called secondary, nodular or simply toxic goiter, is meant another distinct clinical type in which the onset is insidious, the symptoms are gradually progressive, and cardiovascular damage is particularly manifest. A nodular goiter may have existed for years. In some, a single or a few nodules show histologic evidence of overactivity; in others, more diffuse, structural change with the same histologic characteristics is evident.

It should be understood that the distinction thus made is a clinical one. There is no definite proof at the present time as to whether or not there exists a fundamental difference between these two types. However, there are many observations both clinical and histologic which suggest that such a fundamental difference may exist. For the present it is sufficient to affirm that clinically the two types are usually recognizable. It must be understood that a small number of the toxic adenomata when well advanced may assume clinical characteristics indistinguishable from those of the advanced exophthalmic type.

In the present paper only cases which were readily recognized as belonging to one of these two clinical types are considered. Other types, such as endemic goiter, physiologic hypertrophy, colloid goiter, non-toxic adenoma, malignant or inflammatory goiter, although they may show mildly toxic manifestations, or may later become definitely toxic, do not come within the scope of this study.

In the *exophthalmic type* of goiter mild cases undoubtedly occur and may terminate spontaneously. However, most cases run a severe and protracted course. Both

mild and severe cases are liable to recurrences even after an apparent cure has taken place, and such recurrences cannot be anticipated. Judging from clinical observation, permanent tissue damage occurs after a few weeks of hyperthyroidism of this type, notably in such muscle tissue as the myocardium, skeletal and orbital muscles, and in parenchymatous organs such as the kidneys and pancreas. If permanent damage occurs it may or may not become functionally compensated later after hyperthyroidism has been checked. In most cases evidence of such damage, functionally compensated is detectable on critical examination years after hyperthyroidism has been checked even though the patient considers himself well.

In the *toxic adenomatous* type of goiter the situation is quite different. The disease develops gradually. Cardiovascular, gastro-intestinal or nervous manifestations may predominate and are apt to be considered as evidence of primary disease of these organs; whereas, the underlying hyperthyroidism may not be recognized until the fully developed clinical picture of hyperthyroidism is evident. In the meantime permanent tissue damage occurs which may or may not become functionally compensated later after the underlying hyperthyroidism has been checked.

The time element in the treatment of hyperthyroidism is of great importance. If hyperthyroidism is checked early, that is, within three or four months in the exophthalmic type or at the beginning of serious tissue damage in the adenomatous type, such damage as may have occurred will, in all probability, become compensated within a short time after hyperthyroidism is stopped. The importance of the time element in checking hyperthyroidism does not seem to be well understood by physicians in general since most patients with hyperthyroidism are referred to the hospital for treatment long after extensive and permanent tissue damage has been done.

In the treatment of hyperthyroidism, striking (one is almost tempted to say dramatic) phenomena occur. Of these may be mentioned the following:

1. The iodine remission of symptoms obtained after a few days' treatment of the average case of exophthalmic goiter.

2. The results seen immediately following a technically successful subtotal thyroidectomy. The patient himself frequently volunteers the statement that he feels like a totally different person—calm and composed, perhaps on the day following surgical interference.

3. The sudden establishment of a normal mechanism after long periods of auricular fibrillation.

4. The control by ice packs and large doses of iodine of hyperthyroid crises with hyperpyrexia; rapid, forceful, pounding heart action; intense nervousness; restlessness; tremor; apprehension; extreme nausea and vomiting—formerly complained of by patients who have not received iodine treatment. Such clinical observations seem to indicate that we shall be able to control accurately the overactivity of the thyroid gland and the metabolic mechanism with which it is intimately associated when our knowledge of the factors involved is complete. While undoubtedly incomplete, such knowledge as we now possess, when applied to the control of hyperthyroidism, gives as creditable results as are to be seen in the treatment of almost any other disease of equal severity.

There is some difference of opinion as to just what constitutes thyroidectomy. It is evident that the amount of thyroid tissue which is left after removal of the greater

part of the gland varies greatly with different surgeons and with different patients in the hands of the same surgeons. Insofar as the present series of cases is concerned the objective sought was the removal of all save a very small portion (estimated at from 3 to 5 grams) of thyroid tissue without removing the parathyroid or injuring the recurrent laryngeal nerve. Under iodine control such an operation may be readily effected without the danger of the postoperative crises formerly seen.

Following a technically successful operation of this type the manifestations of hyperthyroidism should rapidly disappear. Some evidence of this is seen within twenty-four or forty-eight hours; the basal metabolic rate drops to normal and symptoms of hyperthyroidism disappear by the time the patient is discharged from the hospital. Some cases take a longer time for readjustment, but if the metabolic rate continues to be above normal and symptoms of hyperthyroidism persist, it is certain that an insufficient amount of gland substance was removed, and a second operation should be considered. It is evident that it is not the amount of thyroid substance removed but the amount that is left behind which causes postoperative hyperthyroid crises.

Technical difficulties at the time of operation, such as hæmorrhage or irritation of the recurrent laryngeal nerve, may interfere with the completeness of the operation and a subtotal thyroidectomy may not be possible. In such cases immediate and final benefits are not as a rule obtained. The patient should be kept under observation and in case hyperthyroidism is not checked, a second operation for the removal of thyroid remnants should be considered. This situation has arisen in five of my own cases.

In my opinion, severe hyperthyroidism is a progressively damaging disease which should be controlled before permanent tissue damage has occurred. In contemplating subtotal thyroidectomy as a means of control a certain sense of values and proportion is essential. It must not only be realized that the disease itself is progressively disabling, leading to invalidism or even some danger to life; but that removal of the greater part of such an important structure as the thyroid gland necessarily gives rise to after-effects which may profoundly affect the future welfare of the patient.

At Wesley Memorial Hospital we have been fortunate in having as associates surgical colleagues with rare technical skill, and we have not hesitated to avail ourselves of their counsel and surgical ability in the control of severe hyperthyroidism. All of us, surgeons and internists alike, have been greatly impressed by the results observed following subtotal thyroidectomy and wonder why it is that others, especially some of our internal medical colleagues, for whose medical attainments we have the highest regard, should hold a diverse opinion as to the value of this means of control of hyperthyroidism.

We decided to re-examine as many patients upon whom a subtotal thyroidectomy for the control of hyperthyroidism had been performed prior to one year ago as we could induce to return for this purpose. An additional group operated upon from six to twelve months ago were also recalled for examination and comparison. Only cases that had been operated by Dr. Allen B. Kanavel, Dr. Harry M. Richter and Dr. Sumner L. Koch were examined. The technique of these three surgeons is essentially identical. The surgeons were not only willing but anxious that a searching examination of the patients upon whom they had operated be made and the results of the examination reported accurately. The examinations were conducted entirely independently of the surgeons who had performed the operations.

TABLE I. EFFECT OF IODINE AND BED REST ON BASAL METABOLIC RATE

Fifty-five cases of hyperthyroidism (all types) in which a sufficient number of determinations has been made to warrant conclusions

	Cases
No change in basal metabolic rate	1
Decrease in basal metabolic rate	54
1 to 25% decrease	4
26 to 50% decrease	22
51 to 75% decrease	18
76 to 100% decrease	10

TABLE II. EFFECT OF IODINE AND BED REST ON TOXIC ADENOMATOUS GOITER

Twelve cases in which diagnosis was confirmed histologically; sections did not show hyperplasia

	Cases
1 to 25% decrease in basal metabolic rate	2
26 to 50% decrease in basal metabolic rate	4
51 to 75% decrease in basal metabolic rate	5
76 to 100% decrease in basal metabolic rate	1

TABLE III. PRESENT STATUS OF ONE HUNDRED HYPERTHYROID PATIENTS FROM SIX MONTHS TO SIX YEARS AFTER THYROIDECTOMY AS DETERMINED BY CRITICAL PHYSICAL EXAMINATION

Thyroid status		Cases
Normal		87
Basal metabolic rate above +10% (4 considered hyperthyroid)		5
Basal metabolic rate below —10% (5 taking thyroid extract)		8
Weight: (records complete in 91 cases)		
Gain (average 26.8 pounds)		86
Loss (average 10.4 pounds)		5
Significant visceral injury		
None demonstrated		48
Present		52
Result of hyperthyroidism	41	
Result of operative intervention	8	
Other damage, probably unrelated	6	

TABLE IV. DISTRIBUTION OF INJURY FOUND IN FIFTY-TWO PATIENTS

Interpreted as due to hyperthyroidism:	Cases
Cardiovascular	40
Nervous-mental	14
Weakness	5
Persistent hyperthyroidism (1 significant)	5
Result of operative intervention	
Vocal cord paralysis	2
Tetany	1
Hypothyroid	5
Other pathologic conditions discovered	
Focal infection	3
Diabetes	1
Pulmonary tuberculosis	1
Nephritis of pregnancy	1
Menopause	2
Nephritis with hypertension	1
Rheumatic heart lesion	1
Overweight	1
Diarrhœa	1

(21 patients showed a suggestion of exophthalmos)

TABLE V. PRESENT STATUS OF FOURTEEN HYPERTHYROID PATIENTS OPERATED ON WITHIN THREE MONTHS OF ONSET OF SYMPTOMS

	Cases
Thyroid status considered normal	14
(Extremes of basal metabolic rate + 13 and —13.1%)	
Residual injury:	
None demonstrated	11
Visceral injury, result of hyperthyroidism	2
Focal infection	1

A careful abstract of the hospital record supplemented by direct questioning of the patient was first made; then a critical examination followed by a functional heart efficiency test (hopping) was made and recorded. If injury to the vocal cords was suspected a special laryngoscopic examination was made. If any suggestion of the persistence of hyperthyroidism was observed the patient was requested to return a second time for metabolic rate determination. In most cases the patients have co-operated in this regard. The results of these examinations were tabulated and recapitulations made, as shown in Tables I to V.

Certain isolated facts not readily tabulated were also recorded as follows:

1. There was a definite history of a general infection immediately prior to the onset of hyperthyroidism in fourteen cases.

2. A definite iodine remission of symptoms, more or less complete, occurred in fifty-four of fifty-five recent cases in which iodine was administered in anticipation of operation.

3. Ten patients had been previously treated with x-ray; twenty-seven with iodine; nineteen with bed rest; and one with radium.

4. Of twenty-four cases operated upon six to twelve months ago, postoperative myxœdema was present in three; postoperative myxœdema and tetany in one; tetany alone in one. No ill effects of myxœdema or tetany were noted at time of this examination. Two patients with myxœdema were taking small daily doses of thyroid extract. Of forty-four patients operated upon prior to one year ago none show evidence of myxœdema or tetany at the present time.

CONCLUSIONS

1. Severe hyperthyroidism is a progressively damaging disease which should be controlled before permanent tissue damage occurs.

2. Subtotal thyroidectomy when technically successful will check hyperthyroidism.

3. Subtotal thyroidectomy for hyperthyroidism under iodine control is a relatively safe procedure.

4. Postoperative myxœdema is usually temporary and can be controlled by feeding thyroid extract.

5. Postoperative tetany is probably more frequent than is thought but is usually mild and transitory.

6. Recurrent laryngeal paralysis following subtotal thyroidectomy probably occurs more frequently than is thought, and when unilateral thyroidectomy is performed little or no functional disability may result.

ENDOCRINES AND PSORIASIS

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Almost every possible etiological factor has at one time or another been proposed as the cause of psoriasis. After continued laboratory investigation extending over a period of more than four years, I feel that a basic principle to be considered in the cause of psoriasis is a deficiency of calcium content of the blood, and that this deficiency is due to some hypofunction of one or more glands of internal secretion, with the greatest evidence pointing toward the parathyroid glands.

Over four years ago I was impressed by the fact that more than 85 per cent of the case histories of psoriasis showed some unusual tendency toward hæmorrhage. In one class of cases there was persistent hæmorrhage from the nose, lasting for a period of several days and recurring at irregular intervals. In another group there was abnormal hæmorrhage after tonsillectomy, while in still another there was an interesting predisposition toward bruise marks on the skin or subcutaneous patches even after the slightest trauma. This tendency toward hæmorrhage led to a series of coagulation time experiments, but from these tests I obtained no confirmative data.

It will be remembered that in 1920 Brock (1), who had been investigating the cause and treatment of psoriasis, published the results of his experimental work at the Dermatologic Clinic at Kiel. In this paper he speaks of the stimulation of the thymus gland by the x-ray, giving his formula for length of exposure and areas to be radiated. He reported twenty-two cases. He believed that with small stimulating doses of x-ray at intervals of from six weeks to two months, there was aroused within the gland an increased secretion of some unknown but necessary hormone which was essential to the proper keratinization of the skin. Brock's work was fairly empirical, and was concerned more with the manner of treatment than with the study of the cause of psoriasis.

This work of Brock was followed by a similar group of experiments by O. H. and H. R. Foerster (2) of Milwaukee. They reported twenty-two cases: one case showed no response at all to treatment, because the dosage was too small; there were three failures (the first case was considered a failure because local treatments also had been employed, the second patient was lost sight of, while the third failure was due to improper dosage); there were five cases which showed some transitory improvement; and thirteen cases which were markedly improved or completely relieved of all signs of the disease.

Dr. Shamberg of Philadelphia reported a number of cases at a meeting of the American Medical Association in Chicago, at which time he showed pictures illustrating improvement due to the substitution of a full vegetable diet in place of a high protein diet. His evidence was quite convincing, but in the light of this present experi-

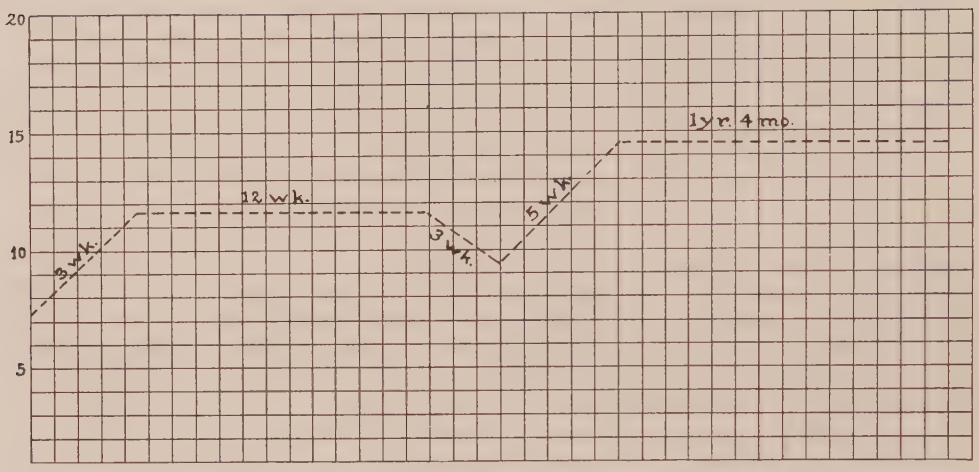

FIG. 1. Calcium curve, showing the close relation between the condition of the disease and the calcium content of the blood.

mental work I feel that his good results were obtained not so much by the removal of the protein from the diet as it was due to the substitution of a diet rich in calcium. The improvement was therefore due to the increase in calcium metabolism and the consequent entering in of calcium into the formation of the new skin cells brought about the desirable change as shown by Dr. Shamberg.

There are but few who have treated many cases of psoriasis who have not at one time or another, because of failure to get results, resorted to the dangerous but commonly followed practice of prescribing liquor potassii arsenitis, knowing full well that it was but to use the medicament empirically and that with the cessation of the use of the drug the disease would soon return; also knowing that if the drug were used for long periods of time there would be grave danger of producing arsenical keratoses of the palms and soles, a condition far more dangerous and discomforting to the patient than the original disease. Even in view of these possibilities, the drug was used because it seldom failed to attain the desired though temporary results. If we look into the report on Fowler's solution as given in the *U. S. Dispensatory*, we see that Gies has found that when newborn rabbits are fed this drug during the first four weeks of their life they show an average gain of 30 per cent more weight than normal. This gain in weight is not due to the deposition of fat, but to the fact that the bones are thicker and longer than normal. This drug therefore influences the calcium metabolism of the newborn rabbits. May it not be fair to assume then that in the human the beneficial effect from this drug may be ascribed to its effect upon the calcium metabolism, and hence its beneficial effect upon psoriasis?

In this paper I wish to report the results obtained in four groups comprising a total of sixty-five cases, which have been under observation for the past three years. First, ten cases in which my modification of Brock's treatment by x-ray has been the only treatment given. Second, ten cases in which parathyroid extract alone was given, either by mouth in the form of tablets, or in the form of the extract of parathyroid

given intramuscularly. Third, eight cases in which calcium lactate alone was given in large doses (5 grams daily). Fourth, thirty-seven cases in which a combination of all three previous methods and full calcium diet were employed.

Of the ten cases in which the modified Brock x-ray treatment alone was used, there was no case in which complete permanent or even lasting remission resulted. By "lasting remission," I mean a result in which for a period of nine months or more there was marked improvement or complete remission with the clearing of all lesions. This length of time was decided upon so that the patient would be carried through the warm sunny months and again into the depths of winter months when the disease usually makes its return. Twenty per cent of the patients showed improvement, but suffered relapses in from one to six months.

FIG 2. Case described in text. See also Fig. 1.

FIG. 3. Before the administration of parathyroid and calcium treatment.

FIG. 4. Five weeks after treatment was started. Same case as shown in Figure 3.

FIG. 5. Before combined treatment had been started.

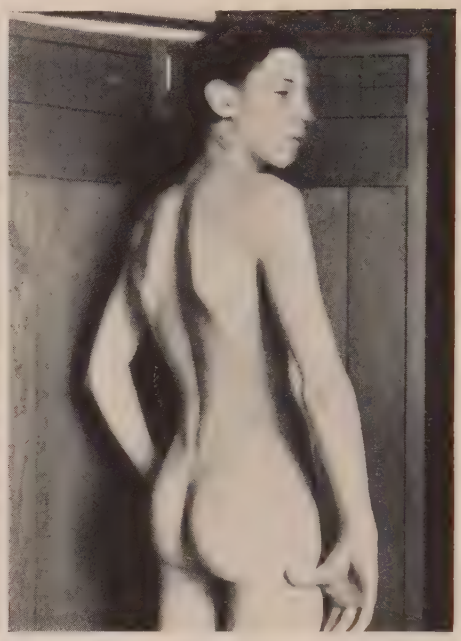

FIG. 6. Five weeks later. Same case as shown in Figure 5.

Of the group of ten cases in which the parathyroid extract alone was used, there was a marked and lasting improvement in 30 per cent of the cases and in 20 per cent there was a complete cure or arrest of all symptoms for more than nine months. I feel that the good results in these cases was due in part to the calcium-rich diet, and that this assisted the glandular extract by furnishing a supply of calcium which could be utilized in the repair of the skin condition.

The third group of eight cases in which large doses of calcium lactate were given by mouth there was a variety of results which may have been due merely to the vagaries of the disease. Two of the cases showed marked and rapid improvement, three remained stationary with neither improvement nor signs of becoming worse, while three seemed to grow progressively worse during the use of the drug.

The fourth series, thirty-seven cases in all, gave most gratifying results. In this series, the chest wall and the anterior aspect of the neck were exposed to the roentgen rays. A mask was fitted over the patient or set below the x-ray tube so that the area exposed should cover the body between the parasternal lines laterally, as far cephalad as the line of the inferior portion of the mandible, and caudad as far as the xiphoid process of the sternum. This made an opening about 18 by 34 centimeters. The tube was placed with the cathode 16 inches from the surface of the body and with a kilovoltage of 110 and milliamperage of 6, the aluminum filter 3.0 millimeters thick was placed in position and an exposure varying from 1 minute 15 seconds in very thin or young children to 2 minutes 30 seconds in normal robust adults was given. This modified Brock x-ray treatment was repeated every six weeks. At five-day inter-

FIG. 7. Before combined treatment had been started.

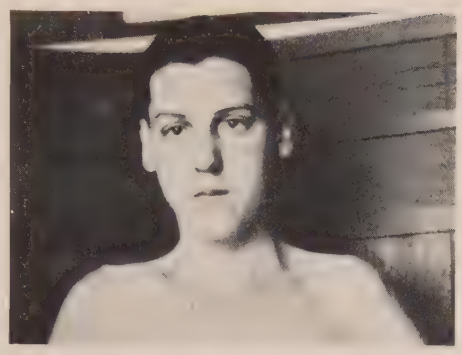

FIG. 8. Five weeks later. Same case as shown in Figure 7.

vals, or in some cases seven-day intervals, 1 cubic centimeter of parathyroid extract was injected into the gluteal muscles. If this intramuscular administration was for any reason inadvisable the tablets of $\frac{1}{20}$ grain of parathyroid, with 2 grains of calcium lactate, were given twice daily by mouth. Large doses of calcium lactate with equal amount of saccharum lactis were given morning and night. The patient was told to put a level teaspoonful of the calcium lactate and milk sugar mixture into a glass of water at night so that by morning it would be completely dissolved and ready to drink. A second dose should then be prepared in like manner for the night. To this method, called the combined treatment, was added a diet rich in calcium. In this diet were included cheese, milk, cocoa, chocolate, egg yolks, nuts, beans, green vegetables, spinach, beet tops, cabbage, lettuce, peas, figs, olives and maple syrup.

The results obtained by this method of treatment in this series were as follows: one case was an utter failure; nine cases showed some improvement but relapses occurred in a few weeks; five cases cleared up and no relapse occurred until after seven months or more had elapsed, so that they might almost be classed as long remissions, and twenty-two cases cleared up completely with no relapses during periods of from one to three years.

The blood in all of these cases has been most carefully followed and analyzed chemically for calcium. It is generally conceded that in the normal there is some range of calcium concentration in the blood, but this range is not very extensive. The fact that we occasionally see a patient who has a low calcium content, and no psoriasis may be due to the usability of the calcium as a result of proper functioning endocrines, but when the endocrine glands, especially the parathyroid, are deficient, the calcium is also deficient and psoriasis may result.

Figure 1 shows the result of a complete follow-up on the blood of one patient for more than two years. When he first came to the office he presented such a severe case of psoriasis (Fig. 2) that it was extremely difficult for him to sit down, because the scaling was so heavy and the induration so marked. The first blood reading was 7.2 (normal being between 11 and 13). The patient was put on the combined treatment of the modified Brock, the parathyroid extract, calcium lactate by mouth and a rich calcium diet. His improvement in the first three weeks was remarkable, but then ceased.

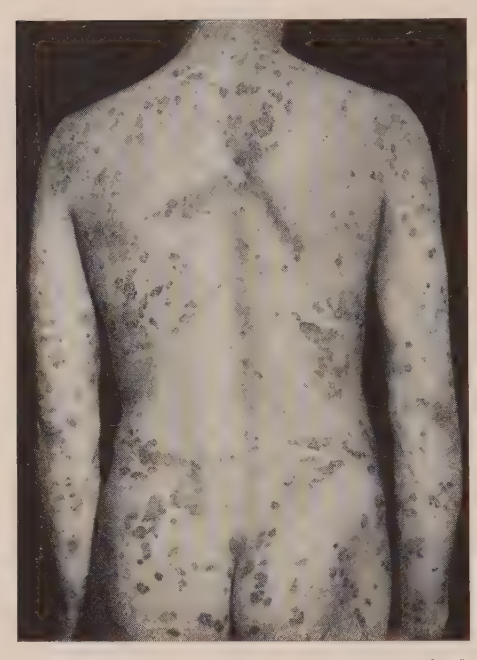

FIG. 9. Appearance before treatment had been started.

FIG. 10. Five weeks after treatment was started. Same case as shown in Figure 9.

At that time he was overworking and suffering from some stomach trouble. A second blood reading was taken and showed 11.2. In spite of continued treatment he failed to improve and for a period of three months his condition remained unchanged (Fig. 1) showing neither relapse nor improvement. He became discouraged and due to conditions over which he had no control he was compelled to continue his work. He continued to have gastro-intestinal disturbances, and hence was unable to take the calcium. After the three months in which there was no change in his condition a third blood reading was taken and showed 11.2. Treatment of all sorts was stopped for three weeks and after the first week there were signs of relapse. The patient returned to the office at the end of three weeks considerably worse than when he stopped treatment, but still not so bad as when first seen. At this time the blood reading was 9.4. He insisted upon more treatment and was put upon the same treatment as before, but he worked less, rested more, and had some recreation. He was then able to take the calcium treatment and showed most gratifying improvement until after five weeks he was practically clear of all lesions, and the fifth blood reading yielded 14.2. Of course this is an isolated case, but one in which the ups and downs of the calcium content of the blood corresponded most closely to the curve of the disease. While I have not been able to follow any other case as fully as this one, many others have corresponded with it in rise of calcium with improvement in the condition of the disease.

With the help of Mr. Bradley Tillotson, in the chemical laboratory at Northwestern University Medical School, I have added to the analyses of bloods in cases of

psoriasis to those I have made in my own laboratory and our readings have corresponded in more than 90 per cent of the duplicate readings. I now have reports on fifty-three bloods, with repeats in many of the cases, but all with analysis as to the calcium content, and in every case so far examined there has been a close relationship between the clinical picture of the disease and the calcium reading when analyzed.

I am convinced from more than three years of experimental chemistry connected with the clinical study of psoriasis that this is a disease which, if not actually produced, is at least profoundly influenced by a deficiency of calcium in the blood, especially when there is associated with it a hyposecretion of certain endocrines, chief among them being the parathyroid. I believe that cases which fail to yield to this form of treatment are complicated with gastro-intestinal defects, which must be remedied before satisfactory results may be obtained. That psoriasis is a disease of infection is but faintly tenable since children born without the predisposition to glanular deficiency may sleep in a scale-covered bed with a scale-casting brother or sister for years and not contract the disease.

There are other ramifications into which this study may lead, but I feel, nevertheless, that there is a definite relationship between calcium metabolism and psoriasis. I also believe, as a result of observation in the twenty-two cases reported as having remissions for a year or longer, that unlike diabetes, where the glandular product must be continued indefinitely, in the cases of psoriasis we at first see lengthened periods of remission with shorter periods of relapses until finally complete and permanent arrest of all symptoms is achieved. Then the administration of glandular extract and calcium may be stopped without harm to the future welfare of the patient.

Two further problems here present themselves for our consideration and further study: first, the study of a series of bloods during long continued high fevers, to determine if in these cases there is a rise of calcium, for we know that many cases of psoriasis clear up temporarily during fever periods to return after the fever had subsided; and second, the study of a series of bloods in normal individuals to see if liquor potassii arsenitis has any effect upon the calcium content of the blood.

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Bon Dupuytren

DUPUYTREN'S CONTRACTION[1]

By ALLEN B. KANAVEL, Sc.D., M.D., Chicago

Professor of Surgery
Northwestern University Medical School

Guillaume Baron Dupuytren, "whom living all admired, but whom few loved, and no one understood,"[2] was born October 5, 1777, or 1778 (his biographers disagree as to the year) at Pierre-Buffière, a small town of Haute Vienne, four leagues from Limoges. Napoleon and Wellington were eight years his senior, Beethoven seven, Turner two, Hokusai seventeen, Sir Astley Cooper nine.

In 1789 a cavalry officer stationed at Pierre-Buffière asked and received permission from Dupuytren's father, an advocate of limited means, to send the boy to school in Paris. There he studied for four years until the schools were closed in the turmoil associated with the Revolution, and for lack of funds the young student was compelled to return the two hundred miles to his home on foot.

To fulfill his father's wishes and because the years at the College of La Marche had aroused his ambition, he determined to return to Paris and study medicine. His ambition was achieved, but only at great self sacrifice. Often he was compelled to study in bed for lack of fuel for a fire. He used fat from cadavers to serve as oil for his light, and at one time he lived for more than six weeks on bread and cheese. It is said that but for the help of a friendly water carrier from Auvergne he would have starved during the earlier years of his medical education.

When scarcely eighteen he was appointed prosector in anatomy in one of the schools established by Fourcroy and from that time fortune smiled on him. In 1801 he was made head of his department with the title of Chef des Travaux Anatomiques. Among his pupils during this period were Laennec and Cruveilhier—men who also attained enduring fame. In 1804 he competed against Roux, Tartra, and others for the position of surgeon of the second class at the Hôtel Dieu and won the appointment. In 1808 he was again advanced; and in 1812 after a brilliant *concours,* in which Tartra, Roux, Marjolin, and Dupuytren were the contestants, he was appointed to the chair of operative medicine as successor to Sabatier. It is said by Malgaigne that his

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[1]A part of a moving picture demonstration on *Surgery of the Hand* delivered by Drs. Allen B. Kanavel and Sumner L. Koch at the Northwestern University Alumni Clinic, June 16, 1927.

A considerable portion of this demonstration was given over to the exhibition of films of pre-operative and postoperative cases of Dupuytren's contraction and occasion was taken to discuss at length the anatomic, clinical, and operative features of the condition. The present article is a résumé of a more complete contribution on the subject entitled *Dupuytren's Contraction* by Allen B. Kanavel, M.D., F.A.C.S., Sumner L. Koch, M.D., F.A.C.S., and Michael L. Mason, M.D., which appeared in Surgery, Gynecology, and Obstetrics, 1929, xlviii, 145–190. The biographical material and cuts from this article are here reproduced through the courtesy of Surgery, Gynecology, and Obstetrics.

[2]Memoir in the *Lancet,* 1835, i, 752.

thesis on lithotomy, submitted to fulfill one of the requirements of the *concours*, was long regarded as a work of art and as a model of surgical and anatomical excellence which up to that time had not been equaled.

During the years preceding and immediately following this appointment an intense rivalry developed between Dupuytren and Pelletan, the surgeon-in-chief of the Hôtel Dieu. The former was a thorn in the flesh to his brilliant but indolent superior, and lost no opportunity of ridiculing the slipshod methods and inaccurate diagnoses of Pelletan before his students. Finally as a result of two unfortunate incidents Pelletan was superseded by his younger rival.[1]

Dupuytren's methods and work at the Hôtel Dieu are recorded by Cruveilhier, one of his students. He arose daily at five o'clock and began the morning round at six, and woe to the house surgeon or nurse who was not on duty at the appointed time. The first task of the day was to make the rounds of the wards, at which time he questioned and examined his patients with great care. One of his house officers was assigned the duty of recording the observations made on these occasions.

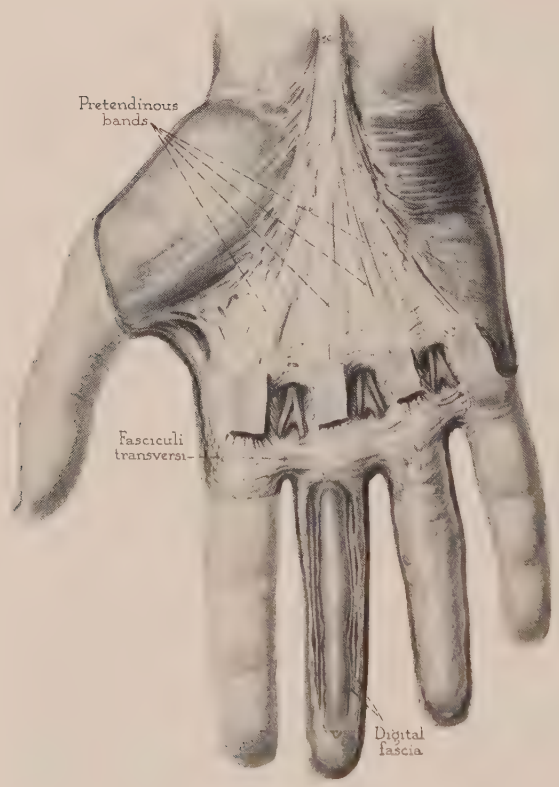

FIG. 1. The superficial palmar fascia — palmar aponeurosis.

[1]The first of these was an ill-advised operation for a massive malignant growth of the shoulder and arm, for which in a joint consultation Pelletan had advised operation, but which Dupuytren had insisted should not be operated upon. In spite of Dupuytren's counsel Pelletan operated upon the patient without advising his colleagues and the patient died immediately afterwards. The second incident is described by Lisfranc who was assisting Pelletan. A Russian officer who had developed a massive swelling of the groin following a gunshot wound of the thigh was operated upon by Pelletan. Following the incision, made for drainage of what had been diagnosed as a deep abscess below Poupart's ligament, a stream of blood gushed from the wound. The hæmorrhage was quickly checked by Lisfranc who, in accordance with Dupuytren's teaching, applied pressure over the iliac vessels. Pelletan, who did not understand the technique of ligating large blood vessels, made two parallel incisions above Poupart's ligament, passed a needle deeply into the tissues and ligated the structures between the incisions *en masse*. He then ordered Lisfranc to release the pressure, and again blood poured from the wound. Packing was introduced as quickly as possible but the unfortunate patient expired. An investigation by a commission of Russian officers was made, and as a result Pelletan was superseded by Dupuytren as surgeon-in-chief.

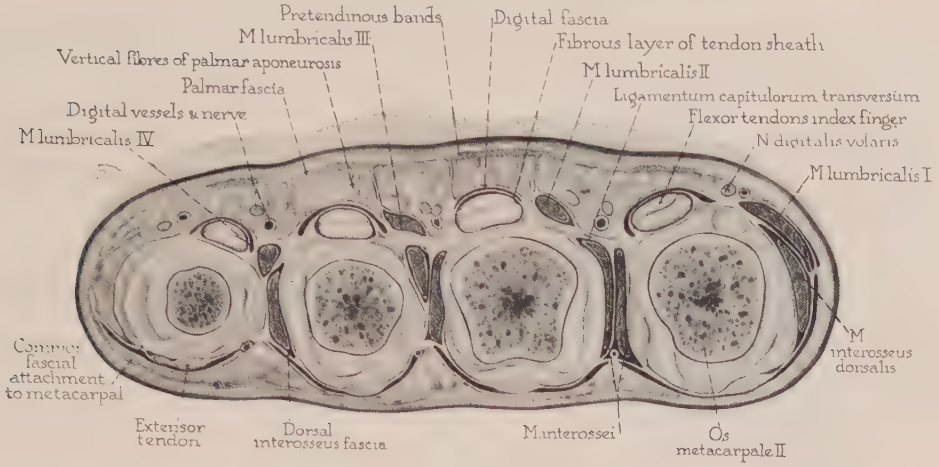

FIG. 2. Cross section of the hand at the level of the metacorpophalangeal joints.

After the morning round he delivered a clinical lecture in the amphitheater of the hospital, usually to classes of three and four hundred. Operations,[1] the out-patient department, and postmortem examinations took up the remainder of the morning. The afternoon was devoted to his consulting practice which became very large as his prestige and popularity increased. It is said that during the later years of his life his private patients numbered ten thousand a year. In the evening he again made rounds at the hospital and frequently performed one or two operations at this time.

Needless to say, he was compelled to pay the price of maintaining so strenuous a pace, without thought of rest or relaxation, year in and year out. One morning at the close of 1833 while on his way to the hospital he suffered a slight stroke of apoplexy. He went through his ordinary routine, but on his return home was immediately bled. On recovering from this attack he made a tour of Italy—his first vacation; but he was unhappy and restless, anxious to resume his work. On his return he attempted to assume his regular activities but finally, because of his increasing disability he was compelled to relinquish his place at the hospital. During the succeeding months he developed a chronic pleuritis which gradually led to a fatal termination February 8, 1835.

Of Dupuytren's ability as a surgeon and teacher there can be little doubt. His biographers unite in considering him the first surgeon of his time and the founder of

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[1]During this period there were five surgical wards at the Hôtel Dieu out of a total of fifteen, with 264 beds, 191 for men and 73 for women. Of these Dupuytren gave 151 to his assistants and reserved 113 for his own service. Approximately 1,400 surgical cases were cared for each year.

Some idea of the amount and type of work performed may be gained from a summary of the work of one year—1818. During these twelve months Dupuytren performed 368 surgical operations, set 178 fractures, and opened 300 abscesses. Included in the first group were 16 cases of fistula *in ano*, 60 of cataract, 4 of lachrymal fistula, 44 of strangulated hernia, 7 of urinary calculi, 9 of hydrocele, 6 of cancer of the lower lip, 17 of cancer of the breast, 3 in which an artificial anus was established, 1 amputation of the upper jaw, 1 of the lower jaw, 10 of the thigh, 2 of the leg, 2 of the arm, and 1 of the forearm.

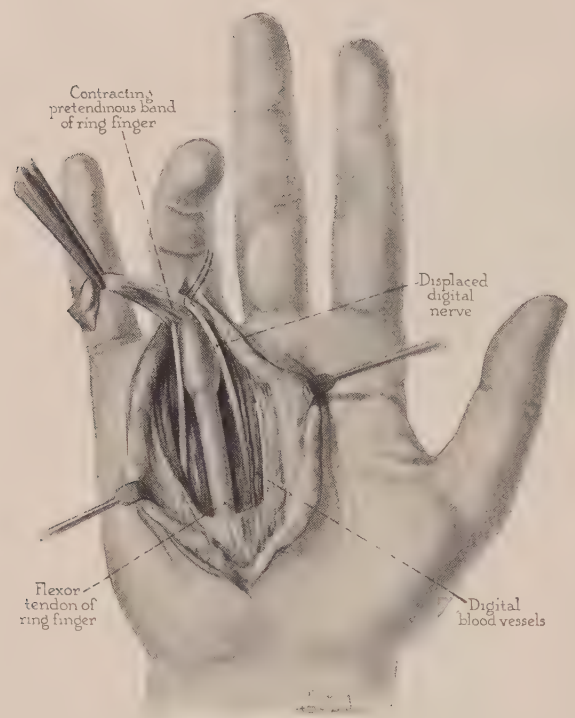
Contracting pretendinous band of ring finger
Displaced digital nerve
Flexor tendon of ring finger
Digital blood vessels

FIG. 3. Ulnar displacement of a digital nerve due to the progressive contraction of the digital fascia. Drawing made at operation.

clinical surgery in France. No field of surgery that he touched but was enriched by his skill and ingenuity. He first demonstrated the nature of yellow elastic and erectile tissue; he proved by animal experimentation that excision of the spleen could be performed with safety; he pointed out the fact that iliac abscess on the right side was frequently due to perforation of the vermiform appendix; he showed that chronic enlargement of the testis was often due to lues and could be cured by "Dupuytren's pill," a mercuric preparation; he introduced greatly improved methods of treating fractures, particularly fractures of the femoral neck and lower end of the fibula; he was the first to excise a carcinomatous cervix, the first to describe congenital dislocation of the hips; he reformed the treatment of urethral stricture by introducing the method of gradual dilatation with flexible bougies. He was particularly interested in the treatment of lachrymal fistula and cataract. His treatment of the latter, however, by couching was not in accord with the best practice of his time, and because of it he was bitterly criticized. Today his name is particularly associated with idiopathic contraction of the palmar fascia,[1] with fractures about the ankle, and with the classification of burns which he suggested. As a teacher Dupuytren's reputation was such that his classes constantly numbered three and four hundred; one writer says

[1]Concerning the controversial question of priority and Dupuytren's contraction Keen says: "Henry Cline, at least as early as 1808, in his lectures alluded to its real character; Sir Astley Cooper also had done the same and even had advocated the subcutaneous method of operating; but nobody paid any attention to them. Dupuytren first compelled a hearing. How emphatically he impressed his views on the profession is shown in the number of theses and other papers that soon followed, and his marchand du vin en gros' and his 'cocher d'environ quarante ans' reappear as familiar friends in nearly every one" and, "It was reserved for Dupuytren in 1831 to proclaim the important fact, based on the dissection of a case . . ." that the condition was due solely to a contraction of the fascia of the hand and not to an involvement of the flexor tendons.

Hutchinson says: "Whether Sir Astley Cooper first suggested the right explanation of this condition (as asserted by one French writer) or not is quite immaterial. But it may remind us of the fact that Dupuytren, though he never visited England. was a friend of Cooper, and that his writings are full of references to his works and those of other English surgeons."

a. b. c. d. e.

FIG. 4. Dupuytren's contraction of the right hand. a, b. Before operation. c, d, e. Nine months after operation.

that audiences of five hundred in the amphitheater of the Hôtel Dieu were not uncommon. His biographers have vividly described him as he appeared before his classes —always dressed in the same round-cut, green coat and white apron, the brim of his green casquette turned back from his forehead and his left hand applied to his mouth; for rarely, no matter in what company, did he cease gnawing the nails of his thumb and index finger. He was not distinguished for his eloquence but possessed the ability to present a subject clearly and forcefully, and to illustrate it with a wealth of detail and of examples observed during the many years of his service at this, the largest of French hospitals. He wrote little; our knowledge of his achievements and teaching is gathered chiefly from the reports of his lectures, the *Leçons Orales,* edited by his pupils Pierre de Boisement and Marx.

His relations with his contemporaries and associates were unfortunate. A few of them have written of him kindly and admiringly; the majority seem to agree with Lisfranc who dubbed him "The Brigand of the Hôtel Dieu." His despotic, arrogant nature, which brooked no contradiction, his jealousy of his contemporaries which led him constantly to seek provincial appointments for potential rivals, his failure to acknowledge the ability or the achievements of others, his almost brutal lack of consideration for the patients entrusted to his care, are blots on his memory which one would like to efface. One is glad to read that hundreds of the working men of Paris followed his body to his grave as a tribute to his service to them and their fellows.

His home life was unhappy; his wife left him because of a scandal; his one passion was his daughter, whom he idolized and to whom he left the greater part of his fortune of more than three million francs, gained through his unaided efforts in the practice of surgery.

Of public honors he reaped a generous share. To have been chief surgeon and dictator of the only large hospital in Paris for twenty years was in itself sufficient to have made his name famous. In 1818 he was elected a member of the Institute. He had been a member of the Academy of Medicine from its foundation and its president in

FIG. 5. Bilateral Dupuytren's contraction with marked deformity of the left hand and palmar nodule at the base of the thumb. a, b. Left hand before operation. c, d, e. Left hand seven months after operation. f, g. Right hand before operation. h, i. Right hand seven months after operation.

1824. In 1820 Louis XVIII conferred a baronetcy on him, and he was surgeon in turn to Louis XVIII and Charles X. During the reign of the latter he was elected to the Academy of Sciences. In spite of all "he was through life absorbed in his professional work; he had no other interests, no politics, no religion, and no friend except his daughter." He died as he lived, a "stern, melancholy, ambitious and bitter man . . . difficult to idealize except as a martyr to his work" (Hutchinson).

In the one hundred years since Dupuytren many theories as to the origin of Dupuytren's contraction and procedures for the cure of this contraction have been advocated, but the etiology still remains obscure. The fact that the area of distribution of the ulnar nerve is usually affected has led many investigators to assume that the condition is primarily one of the nerve. It seems to us, however, that although the fibers of this nerve are intimately bound up in the contracted fascia the involvement

is purely secondary. The idea of trauma as an etiological agent has been the most popular and Dupuytren's wine merchant goes stamping down the pages of history as a perfect example of the traumatic etiology. Curiously enough the condition is as frequently found among bankers and ministers as it is among laborers. The fact also that the condition is most often bilateral speaks strongly against a traumatic origin. It occurs usually in the latter decades of life, more often in males than in females. There is surprising lack of complaint from the patient except that occasioned by functional disturbance. We have not found a higher incidence of focal infection, as for example in the teeth or tonsils, than is found in any other group of patients.

FIG. 6. Dupuytren's contraction with pathology confined to the left ring finger.

The pathology is essentially that of an overgrowth and contraction of the palmar fascia. Anatomically this fascia is in effect the prolongation of the tendon of the palmaris longus muscle in the palm of the hand (Fig. 1). It spreads out fan-like from the wrist toward the base of the fingers. As it approaches the heads of the metacarpal bones it divides into four slips, the fibers of which insert in large part in the skin under the distal palmar crease. Other fibers run on to the fingers and become continuous with the fascia of the fingers. From the lateral border of the palmar aponeurosis a rather broad group of fibers spreads out over the thenar eminence, and here many of them end in the skin in the same fashion as do the digital slips. Uniting the longitudinal bands of the fascia are many transverse fibers. Over the lumbrical spaces where the vessels and nerves lie imbedded in the fat, these transverse fibers are missing. In the distal edge of the webs between the fingers there is a second series of transverse fibers—the fasciculæ transversæ. From the deep surface of the palmar fascia broad bands of fascia (Fig. 2) pass deep into the palm where they become attached to the metacarpal bones. These deeper parts of the palmar aponeurosis are frequently involved in the contraction, and a knowledge of their presence and relations is necessary for a thorough removal of all the affected tissue. On the fingers two layers of fascia can be demonstrated, between which lie the digital vessels and nerves. It is because of this relationship to the fascia that we often find the vessels and nerves pulled over to the midline of the finger or even to the opposite side (Fig. 3). Microscopically the tissue removed is essentially like scar tissue,—dense, white, fibrous connective tissue which has involved secondarily the fibers of nerves passing through it. In places these nerves are surrounded by a very thick wall of fibrous tissue, but there does not seem to be any evidence of nerve degeneration.

The condition begins as a rule on the ulnar side of the hand with an increase in the connective tissue elements of the fascia, starting usually as a small nodule under the distal palmar crease over one or more of the metacarpophalangeal joints. This nodule may be mistaken, before the flexion deformity of the fingers has appeared, for a fibroma. As a rule the disease develops first in the ring finger (Fig. 4) and somewhat less frequently in the little finger (Fig. 5A and B). The radial side of the hand is much less frequently affected, though the thumb and index fingers may suffer con-

traction as well as the little or ring finger. As the disease progresses the affected fingers are drawn down into the palm of the hand with marked flexion of the first interphalangeal joint, somewhat less marked flexion of the metacarpophalangeal joints, and considerably less marked or no flexion of the distal interphalangeal joint. When the contraction is fully developed the tip of the finger may rest in the palm. When the little finger is affected the ring finger also shows some involvement.

On examination the skin of the palm presents a puckered appearance especially over the distal flexion crease, and the nodules over the metacarpal heads can be felt. The skin in this region is immovable. Beginning at about the middle of the palm or at times just distal to the wrist one can feel dense bands of tissue running toward the bases of the affected fingers. When the disease is well advanced these bands may be felt along the volar surfaces of the fingers; some bands may also be felt along the lateral sides of the affected fingers. These have been frequently mistaken for tendons although these are never affected. The rate of development of the disease is quite variable. In some individuals the disease progresses to its full development in a few months, in others several years elapse before the final state is reached. Both hands may be affected at once (Fig. 6), or development of the affection in one hand may precede that in the other by several months or years. When both hands are affected one may be much more involved than the other. There is usually no pain or any subjective disturbance, though at times there may be numbness and tingling over the fingers due to nerve compression.

None of the palliative or less radical types of surgical procedures offers any hope for success. Subcutaneous incision and division of the contracted fascia followed by splinting was for a long time the accepted treatment, due probably to the fact that radical dissection of the palmar aponeurosis was frequently followed by severe infection. The injection of various solutions into the palm does not promise any success. X-ray and radium treatment may give temporary relief, but cannot be relied upon for a permanent cure. Physiotherapy alone will not accomplish much.

The best treatment is complete removal of the affected portion of the palmar aponeurosis with or without the transplantation of skin. If it is not possible to remove the fascia completely without sacrificing skin in so doing it is advisable to sacrifice the skin and replace it by a graft. Where the skin is scanty, thin and fibrotic and not easily brought together, time and vexation will be spared if no attempt is made to save it. Failure of an operative cure is often due to conservatism in the removal of skin. Various types of incisions have been advised for the approach to the palmar fascia. At one time a palmar flap with its base at the wrist was used. Such a flap has a poor blood supply and sloughs are likely to occur.

We are at present using a longitudinal incision running from the base of the palm on to the finger most involved, with a slight curvature, usually toward the palm, to prevent a contracture of the skin as the incision heals. The skin is then raised from the fascia beneath it, and beginning at the wrist the palmar fascia is picked up and dissected free. The nerves and vessels are identified and the dissection is carried distally toward the fingers, care being taken to remove the deep prolongations into the palm. It is to be remembered that the nerves and vessels lie between two layers of fascia on the fingers and that with contracture of this fascia there may be marked distortion of the normal relation. It is essential that the nerves and arteries be identi-

fied before the fascia is removed. After the removal of all of the affected tissue the fingers may be straightened out to their normal position. If, when an attempt is made to close the incision, too great tension is put on the skin, especially at the base of the fingers, it is advisable to transplant skin. Fat transplantation, although made in some earlier cases, is no longer advocated. After closure of the wound it is well to put the hand on a dorsal splint for two or three weeks if there has been shortening of the flexor tendons due to the long duration of the disease. Otherwise we feel that splinting can be dispensed with. Sutures should be left in place for from two to two and one-half weeks. Physiotherapy may be begun in two weeks if no skin grafting has been done.

The majority of our patients have had complete functional return. In two cases, in which at the first operation a complete removal of the fascia was not done, there has been recurrence. The recurrence may be slow, or quite rapid. Where one hand has been operated on it is not infrequent for the other hand to become involved later. Immediately after operation a moderate inflammatory reaction about the line of incision may simulate a recurrence. This, however, completely disappears.

TUMORS OF THE HAND

By MICHAEL L. MASON, M.A., M.D., Chicago

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Epitheliomata of the hand comprise about 5 per cent of all skin carcinomata. However, in view of the fact that the skin of the hand is subjected to considerable trauma remarkably few carcinomata develop there. Ninety-five per cent occur on the dorsum of the hand. In the etiology, chronic irritation, such as comes with lupus, ulcers of various types, fistulæ from osteomyelitis, x-ray (Fig. 1) and radium dermatitis, account for the greater percentage. Scars, especially from burns, are frequently noted and are often twenty, thirty, or more years old. Eczema and arsenic dermatitis are sometimes noted as etiological factors. A few tumors develop from previous growths, such as nevi, and in these instances the patients are usually young. In von Brun's collection of 368 cases, forty-eight cases developed *de novo*. Pathologically, 80 per cent of the hand carcinomata are of a squamous cell type being made up of anastomotic branches of prickle cells with many epithelial pearls. Round cells and polymorphonuclear infiltration are often present. Clinically they are lesions of advanced years, the majority of patients being from sixty to seventy years of age. When the tumors occur in a young person they usually develop from some previous neoplasm. Beginning as a nodule or a fissure, a small ulcer appears which may at first be covered with a scale or crust; as it develops the borders become hard and rounded and a serous or seropurulent discharge appears. At times large cauliflower-like masses develop and may erode through any or all of the structures of the hand. Pain usually occurs late; œdema and functional disturbance of the hand also occur late. The prognosis is good if operation is performed early. These tumors are, however, potentially very malignant. Hazen reports that 80 per cent of this type of carcinoma show glandular enlargement five years after development. Simple local removal is practically sure to be followed by recurrence. Amputation of the finger and metacarpals with a subsequent thorough cleaning of the epitrochlear glands and of the axilla usually produces a satisfactory result.

Fibromata of the hand may develop from the skin, subcutaneous tissues, fascia, tendon sheaths, or perineurium, the majority appearing on the dorsum of the left hand, usually on the fingers. Females are more frequently affected than males. Pathologically the tumor consists of connective tissue with a variable amount of hyaline intercellular substance. Some pathologists would include keloids in this group, claiming that the keloid is not true scar tissue, because elastic fibers never appear in it. The fibromata show various degenerative changes, such as cystic formation, calcification and rarely ossification. They may be associated with lipomata or chondromata, and some may harbor malignant changes, such as carcinomata or sarcomata. Prognostically they are benign, although nevertheless treacherous. A few are recurrent. Diagnostically they are likely to be confused with epidermoidal cysts which rarely

occur on the dorsum of the hand or with the early nodules of Dupuytren's contracture.

Epidermoidal Cysts (*Implantation Cysts*) (Fig. 2C, D) may be either of traumatic or inflammatory origin. The traumatic theory is one of the oldest and most enticing. According to this theory small bits of epithelium are carried down into the deeper tissues where they proliferate and form cysts. Cysts of this type have been produced experimentally by transplanting skin into subcutaneous tissue and muscle. Clinically, there is generally noted in the history injury from splinters of wood or steel. Woerz noted trauma in twenty-four of fifty-five cases and in Pietzner's series trauma was present forty-three times in seventy-five cases. The majority of cases occur in males, probably because man is more frequently subject to trauma. The cysts usually develop on the volar surface of the thumb, where they form tumors varying from the size of a pea to a walnut. They rarely cause any symptoms, although some are painful. Pathologically, they are made up of epithelial lined cysts; some are merely small epithelial pearls. The different layers of the skin can usually be identified in the wall of the cyst. They contain amorphous débris consisting of desquamated epithelial cells and cholesterol. Hair and other structures do not occur. They are surrounded by a thick layer of connective tissue in which giant cells are occasionally found.

FIG. 1. Roentgen carcinoma of the dorsum of the right hand of a physician. Specimen preserved in the Frederick Zeit Museum of Pathology.

One of our patients gave a history of injury to the finger by a thorn in 1887. There was considerable pain for four or five years following the injury. In 1914 the pain reappeared and a small tumor developed on the ball of the left fifth finger. This was removed in 1926, forty years after the original trauma.

Ganglia are histologically simple, but etiologically somewhat obscure. The early writers confused ganglia with tuberculosis of the tendon sheaths. True ganglia are not tuberculous. Numerous theories have been advanced as to the pathogenesis of these lesions. The oldest theory, that of herniation of the tendon sheaths or joint capsules, has been abandoned. Fetal rests of joint tissue or of tendon sheath tissue were once thought to develop into ganglia, but this theory has also been abandoned. Various folds and crypts of joint synovia were at one time thought to form ganglia. At present, however, most pathologists believe that ganglia result from a cystic degeneration of a connective tissue nodule developing in tissues about tendon sheaths or joints or developing in the tendon sheaths following chronic irritation. Possibly normal bursæ, such as are present over the wrist, may become chronically inflamed and form ganglia. Adventitious bursæ which may develop on the wrist may also form a small percentage of the ganglia. Pathologically, they have been classified as tendogenous, arthrogenous

FIG. 2. A. Carpal ganglion of the wrist of a violinist. B. Fibroneuroma of six months' duration. It was non-traumatic and not associated with other tumors. C. Epidermoidal cyst of the volar surface of the right middle finger following trauma. D. Roentgenogram of finger shown in C, demonstrating absence of bone involvement.

and periosteal. They are made up of a connective tissue sac with or without a lining of flattened synovial cells and contain a glary gelatinous material. There is usually one large cyst, though in some cases multilocular cysts develop. The majority are located on the dorsum of the wrist (Fig. 2A), more toward the radial than toward the ulnar side; a few develop on the fingers; some develop about the ankle; and some have been reported as developing about the knee joint. Clinically, they occur more frequently in females than in males, usually developing during the third and fourth decades. They occur particularly on the hands of those individuals who subject their fingers to fine, vigorous movements such as piano playing, violin playing, and typewriting. (It is doubtful if single trauma ever causes ganglion.) They are of slow progressive growth usually developing to their full size, ranging from that of a pea to that of a walnut, within from three to seven months. Subjective symptoms are rarely present. There may be a feeling of weakness and discomfort in the wrist, and at times neuralgic pains.

The old treatment consisted of "squashing" the cyst with a book or with the thumb nail. The German writers distinguish between the ripe and the unripe ganglia in their methods of treatment, claiming that in the unripe cyst, which is multilocular, operation is usually not successful unless the tissues about the ganglia are scarified to allow free absorption. English and American writers do not make this distinction, but advise thorough extirpation. If the ganglia are thoroughly removed they will not recur. Function may be fair or good after operation. In the case of musicians, however, a rather cautious prognosis should be given.

Lipomata rarely occur on the hand, probably, as Virchow pointed out, because of the type of skin and density of tissues. They occur more frequently in males than in females, thus reversing the ordinary incidence of lipoma. The most frequent location on the hand is on the palm, very rarely on the dorsum. Seventy-five per cent occur on the right hand. They may develop subcutaneously or subfascially, and are usually circumscript although occasionally quite diffuse. They may be associated with fibromata. The French point out that laborers, especially farmers, are most frequently affected. Clinically, lipomata form soft, circumscribed or, less often, diffuse tumors; but if considerable connective tissue is present they may be confused with fibromata.

The mass may be as large as an orange. The diffuse type may spread through the interosseous spaces to the dorsum of the hand. Growth is slow and steady, and but few symptoms are noted. Diagnosis is usually not made before operation. Recurrence after extirpation is practically unknown.

Venous Angiomata (Fig. 3) or venous cirsoid angiomata are the counterpart of the arterial cirsoid angiomata, more commonly known as cirsoid aneurisms. Cirsoid aneurism occurs quite frequently on the hand. Sonntag in 1919 collected reports of twenty-four cases. In our series there are no examples of the arterial type. The venous angioma occurs more commonly, and is usually situated on the palm of the hand and on the thenar or hypothenar eminences. It is not as progressive as the arterial type, although in the literature many cases have been reported of a progressive venous angioma associated with marked swelling of the hand and arm, tissue destruction, and increase in length of the extremity. There is a tendency to recurrence following removal of the angioma.

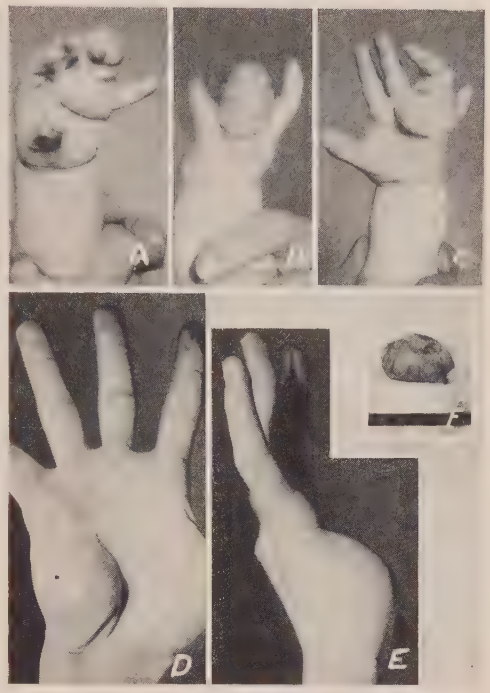

FIG. 3. A, B, C. A progressively enlarging congenital hæmangioma of the left hand of a child eighteen months old. D and E. Angioma of the hypothenar eminence following trauma. F. Gross specimen of tumor shown in D and E which was fibrous and shelled out in its entirety.

Xanthomata (isolated giant celled xanthomata) of the hands and fingers are variously known as myelomata, myeloid tumors of the tendon sheaths, myeloxanthomata, pigment bearing fibrosarcomata, endotheliomata, granulomata, etc. They develop not only from the tendon sheaths, but also from the bursæ, joints, ligaments, subcutaneous tissues, and palmar fascia. Grossly they form nodular tumors varying in size from that of a hazelnut to that of a walnut, and are colored yellow and red. On cut section they have a marbled appearance and strongly resemble adrenal tissue. The yellow color from which the tumor receives its name does not come from the cholesterol which it contains, but from carotin and xanthophyll. Microscopically (Fig. 5) the xanthomata are characterized by giant cells, mainly of the foreign body type, containing as many as 400 or 500 nuclei. Débris from cellular destruction, lipoids, and blood pigments are present in the giant cells. The xanthoma cells or foamy cells are large and polyhedral, with one to three or four nuclei, containing a finely granular cytoplasm in which lie vesicles containing cholesterol. They may make up large areas of the tumor, or there may be merely a diffuse scattering of foamy cells throughout the tissue. It seems that in isolated xanthomata the foamy cells develop from connective tissue cells and from endothelial cells by taking up lipoids in the

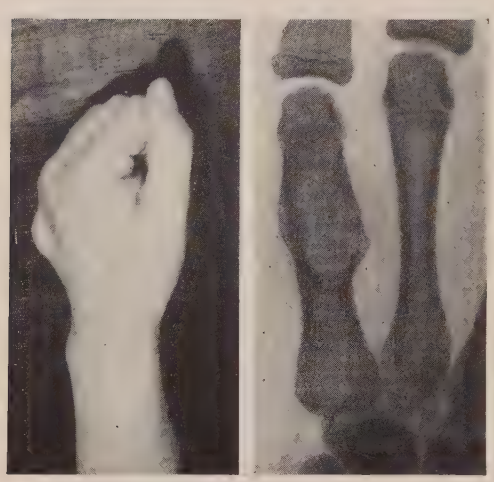

FIG. 4. Enchondroma of seven years' duration in a child eleven years of age. The volar surface of the bone of the fifth metacarpal had not been destroyed.

form of cholesterol following tissue destruction. Pigment is usually plentiful, gives a Berlin-blue reaction for iron, and is obviously a product of the destruction of red blood cells in the tumor. Round cell infiltration is often noted and many areas of the tumors are made up of spindle cells which are probably fibroblasts. Many small capillaries are noted in some of the tumors; in others large sinuses which give the tissue the appearance of an angioma. Females are somewhat more frequently affected than males. In a collected series of 122 cases, sixty-eight of the patients were females and fifty-four males. In our series trauma was noted in five out of eight cases. Xanthomata generally occur during adult life, and usually on the arm. Of 123 cases ninety-six were on the arm and twenty-seven on the leg. Of those occurring on the arm 65 per cent occurred on the right hand. In decreasing order of frequency their occurrence was as follows: on the index finger, thumb, middle finger, little finger, palm, ring finger, and wrist. The majority occurred on the flexor surface of the hand. The question of hypercholesterolæmia in the etiology of these isolated tumors has not been definitely settled. There are many investigators who believe that the development of these tumors is associated with an increase of the blood cholesterol. The evidence, however, on which this assumption is based seems to us to be entirely inferential. We do not know of any cases that have been reported of isolated xanthomata of the hand in which an increase of the blood cholesterol has been demonstrated. In three of our cases blood cholesterol determinations were made and in each case were found to be within normal limits. We are inclined to look upon these tumors as inflammatory growths, somewhat of the nature of granulation tissue, because any of the tissue elements found in these tumors may be present in granulation tissue. Symptomatically they produce few symptoms aside from that of swelling. They have the consistency of a fibroma, and not, as one would suppose, the soft consistency of a lipoma. This characteristic firmness of texture associated with the typical coloration is sufficient to establish an operative diagnosis. Although in a certain percentage of cases recurrences are noted, there is no evidence that this type of tumor is malignant. If removal is thorough, they do not tend to recur.

Chondromata (Fig. 4) occur most frequently on the hand, and are more often multiple than single. When they are multiple they are frequently associated with Ollier's disease. Numerous theories have been advanced as to the etiology of the multiple enchondromata of the hand, some authorities claiming that these growths are the result of multiple cartilage rests, others claiming that they are the result of vascular disturbances, as evidenced by the frequent association with nevi. Some

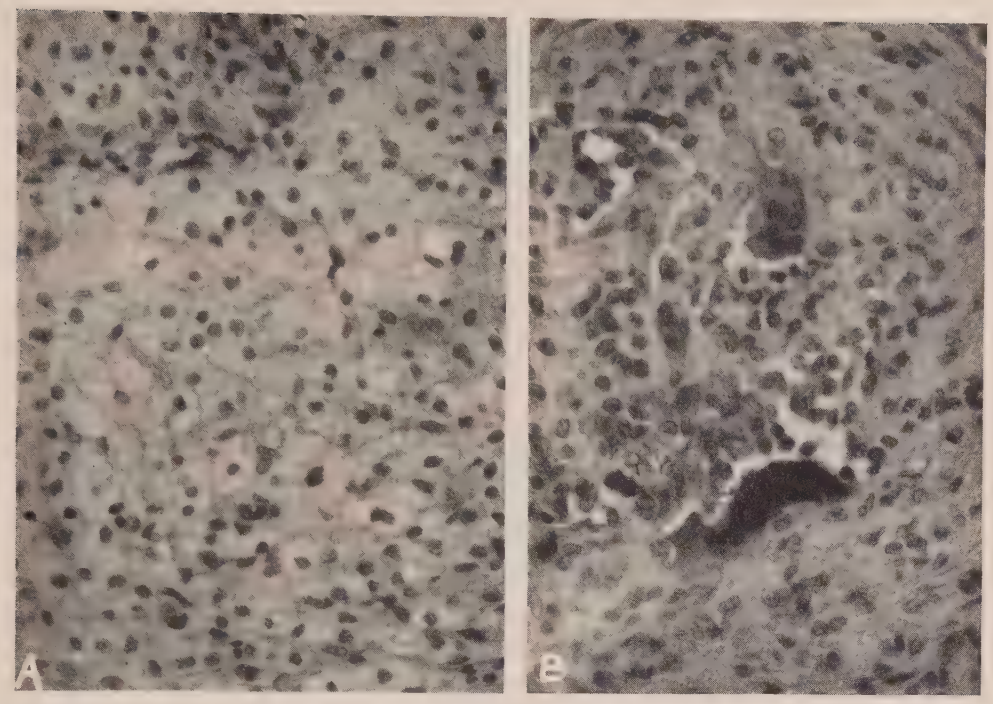

Fig. 5. Histology of xanthoma. In A are shown the large foamy cells characteristic of all xanthomatous conditions. In B are shown the foreign body type of giant cells, the endothelial cells and fibroblastic stroma.

authors believe that rickets plays a part in the etiology. Probably in the multiple and deforming enchondromata there is a disturbance of the enchondral ossification, not only of the upper extremity, but of the leg as well and often of the spine and pelvis. Thirty per cent of the cases are single; 70 per cent multiple. Single tumors usually follow trauma. In both single and multiple cases the right hand is the most frequent site. Pathologically the multiple type develops from the endosteum of the short tube bones of the hand. The single type may be connected with the bone or may have no connection whatsoever with osseous tissue. The growths are made up of islets of hyaline and fibrous cartilage separated by bands of connective tissue, and are usually fairly vascular. The bone in which they develop may be expanded in much the same fashion as in the giant cell bone tumors. In some of the multiple enchondromata occur gross malformations of the radius, ulna, humerus, and, rarely, of the femur. Clinically they usually begin in the period from the ninth to eleventh year, but some are present from birth. Males are more frequently affected than females. In the single tumors in which a history of trauma is often present, the age incidence does not seem to be of significance. Rounded, painless swellings varying in size from that of a pea to that of a hazelnut are formed, usually affecting two or more bones of the hand. Some may be very large and affect many bones in the hand, producing extreme and grotesque distortion. The prognosis should be guarded,

especially in the multiple type. Single chondromata do not tend to recur after removal. The multiple type occasionally develops slowly and progressively. The soft chondromata are frequently subject to malignant changes.

Osteogenic sarcomata have been reported as developing in the hand. Periosteal sarcoma has never been reported, so far as I know, developing from the bones of the hand. Giant cell bone tumors and bone cysts are of rather frequent occurrence in the metacarpus. Exostoses when so reported seem in many instances to be chondromata rather than true exostoses. Minute cysts of the navicular and metacarpal bones are reported and probably are of traumatic origin.

Fibromata of von Recklinghausen's disease may occur on the hand, and isolated neurofibromata (Fig. 2 B) are occasionally observed. Amputation neuromata are frequently met with on the hand. Various nerve cysts have been reported on the radial and ulnar nerves of the forearm. A case of xanthoma in the sheath of the ulnar nerve has been reported.

Tendon sheath tumors are most usually xanthomata. Sarcomata have been reported but are not of high grade malignancy. A lipoma arborescens, fibroma, or chondroma may occur but only rarely. Tumors of the tendons are extremely rare. Fascial sarcomata and fibromata also occur.

Smooth muscle tumors occurring in the skin have been reported.

Melanotic Whitlow of Hutchinson is a melanocarcinoma developing at the base of the nail. It produces a fungus growth of great malignancy. Other melanotic carcinomata have been reported on the dorsum of the hand. They produce few symptoms until wide metastases have occurred.

Lymphangiomata of the hand, except for certain nevi which are of this type, are of very infrequent occurrence. Paltauf has reported a case of a very extensive lymphangioma of the hand which had infiltrated and replaced all of the tissues up to the middle of the forearm.

DIABETES INSIPIDUS

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Willis in 1647, was the first to describe the disease which is characterized by polyuria without the presence of sugar, and he named it "diabetes insipidus." Osler described the disease as a chronic infectious condition, characterized by the passing of large quantities of normal urine with low specific gravity; to this description should be added the feature of a constant polydipsia. This differentiation excludes the larger group of polyurias which are of more or less definite symptomatic origin. The theory now generally accepted is that true diabetes insipidus is the result of lesion either to the pituitary gland, the tuber cinereum, or the contiguous nerve structures.

Experimenal study has given rise to conflicting opinions as to the exact location of the lesion which will result in the production of polyuria. Some investigators believe that the lesion is located in the pituitary body (pars intermedia or pars posterior), while others believe that the injury involves the nerves in the hypothalamus, especially in the tuber cinereum.

S. A. Mathews in 1915 produced a typical diabetes insipidus in each of two dogs by inserting a piece of rubber dam against the posterior lobe of the pituitary body. This caused no disturbance of the gland, as the wound healed by first intention, but the dogs became fat and lazy, and showed changes typical of hypopituitarism, i. e., atrophy of the gonads. However, the lesion would appear to have been irritative since it caused increased secretion. At postmortem examination enormous deposits of fat were found in all of the organs.

Camus and Roussey, in 1913, reported a series of experimental polyurias in which the pituitary gland was removed first, later the region between the tuber cinereum and mammillary bodies was partially destroyed by cautery. As a result of this procedure constant polyuria was produced in the dogs.

Human diabetes insipidus is a disease of many years' duration in persons who are often apparently normal otherwise. Experimental production of the disease, therefore, must produce a polyuria of an indefinite duration. If microscopic and pharmacologic studies are to be made on experimental diabetic dogs, the excretion of urine must be constant over a long period of time and without any marked daily variation. The following experiments were undertaken with the hope of producing such a polyuria and being able to make a detailed study of the condition.

Operative approach to the region of the pituitary gland and tuber cinereum is possible in two ways: (1) through the temporal region, by lifting up the brain, but this causes stretching and possible injury of the pituitary stalk; and (2) through the pharyngeal route in which the landmarks are accurate enough so that it is possible to make a small drilled opening and expose only the pituitary. All of the

experiments here reported have been conducted by means of the latter technique and may be summarized as follows:

1. Complete removal of the pituitary gland always produces a marked polyuria, which lasts for a period of four or five days, after which the dog either dies or recovers. In the latter event the polyuria ceases.

2. Following the work of Mathews, pins have been inserted into the pituitary body through a small drilled opening without damaging the surrounding structure, but in every instance this procedure failed to produce more than a temporary polyuria.

3. Removal of the anterior lobe or of the posterior lobe has never produced a constant polyuria.

4. Drilling over the pituitary body and sufficient incision of the dura to allow herniation of the pituitary body without further manipulation has produced a constant polyuria which in many cases has been of indefinite duration. In some instances the dogs have also shown the regressive changes characteristic of the syndrome known as hypopituitarism, i. e., marked gain in weight and atrophy of the gonads.

5. Through drilled openings posterior to the pituitary body, pins have been inserted into the area between the tuber cinereum and mammillary bodies without the production of a persistent polyuria.

The dog which I am now showing was operated upon 180 days ago. An opening was made posterior to the pituitary and the region posterior to the tuber cinereum was injured by a puncture. This dog has passed as high as 6 liters of urine a day. For a long period of observation before operation the normal output averaged 350 cubic centimeters. On no day since the operation has this dog failed to pass less than twice the normal amount. He has gained 15 pounds in weight, the hair has become fine, and there is complete atrophy of the external genitalia. In other words, there has been produced in this dog a true experimental polyuria which has lasted over a long period of time and there has also developed a syndrome usually considered to be that of hypopituitarism, under conditions in which the pituitary body was presumably not injured.[1]

Clinically, we have collected a group of twelve cases in which we have been unable to determine any definite pathology either in the pituitary or in the hypothalamus. In all of these cases there is a true diabetes insipidus, in that large quantities of urine of very low specific gravity are passed. Careful metabolic studies have shown that with the exception of water, the constituents of the urine are normal in total amount, but are present in very low concentration. In all of these cases pituitary extracts have been administered and it has been found that when the pituitary substance is given by mouth it is ineffective, but that when the pituitrin is given hypodermically a practically normal urine is secreted.

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[1]This dog has been killed, and serial microscopic sections of the pituitary body and adjacent nerve tissues have shown a perfectly normal pituitary gland and stalk. In the nerve tissue 2 millimeters posterior to the tuber cinereum was found a sterile abscess 6 millimeters long, 3 millimeters wide. This finding is in accordance with the early work of Camus and Roussey on the production of polyuria, and the changes in body formation and in the gonads are in conformity with the work of Dr. Philip E. Smith. Recently a number of injections of tar into the same region without injury to the pituitary have produced constant polyuria.

THE RELATION OF THE CIRCULATION OF THE LIVER AND SPLANCHNIC AREA IN GENERAL TO THE SYSTEMIC CIRCULATION

By JAMES PERSONS SIMONDS, Ph.D., M.D., Chicago

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The present study of the relation of the hepatic to the general circulation grew out of experiments on anaphylactic shock. The manifestations of anaphylactic and peptone shock vary in different animals. In the guinea pig the chief clinical symptom is difficulty in respiration; the animal dies from suffocation and at autopsy the lungs are found to be over-distended with air. In the rabbit there is a fall in arterial blood pressure and at autopsy the right side of the heart is found to be markedly dilated. In these two animals the clinical manifestations of anaphylactic shock have been found to be due to a contraction of smooth muscle. Auer discovered that the guinea pig differs from other animals in that its bronchioles contain a relatively great quantity of smooth muscle. The contraction of this muscle interferes with expiration and is the cause of the symptoms of anaphylactic shock in this animal. Coca showed that the pulmonary vessels of the rabbit contain a relatively large quantity of smooth muscle, the sudden contraction of which in anaphylactic shock so interferes with the flow of blood through the lungs that the systemic blood pressure falls and the right side of the heart is over-burdened and dilates.

We began our experiments on anaphylactic shock in the dog. In this animal the shock is characterized by a sharp fall in arterial blood pressure and in pressure in the right auricle, a simultaneous sharp rise in pressure in the portal vein, a marked increase in the size of the liver and in the quantity of blood which it contains, and an increased outflow of lymph from the thoracic duct. Three of these phenomena are shown in Figures 1 and 2. Figure 1 is a chart showing the simultaneous pressures in the portal and jugular veins and the carotid artery in non-fatal peptone shock. From this tracing it is seen that the portal pressure rises a little before the carotid pressure begins to fall and the arterial pressure does not return to normal until the portal pressure also has returned to normal. Figure 2 is a chart from a case of fatal peptone shock in which it is seen that the portal pressure rises and remains high, and the carotid pressure falls and remains low until death occurs.

In attempting to formulate a hypothesis that would satisfactorily explain all of the phenomena of anaphylactic shock in the dog it appeared that there must be some obstruction of the flow of blood through the liver. The only place at which this obstruction could occur and give rise to a simultaneous increase in portal vein pressure and increase in size and blood content of the liver would be in the hepatic veins. Inasmuch as anaphylactic peptone shock in the guinea pig and rabbit had been shown

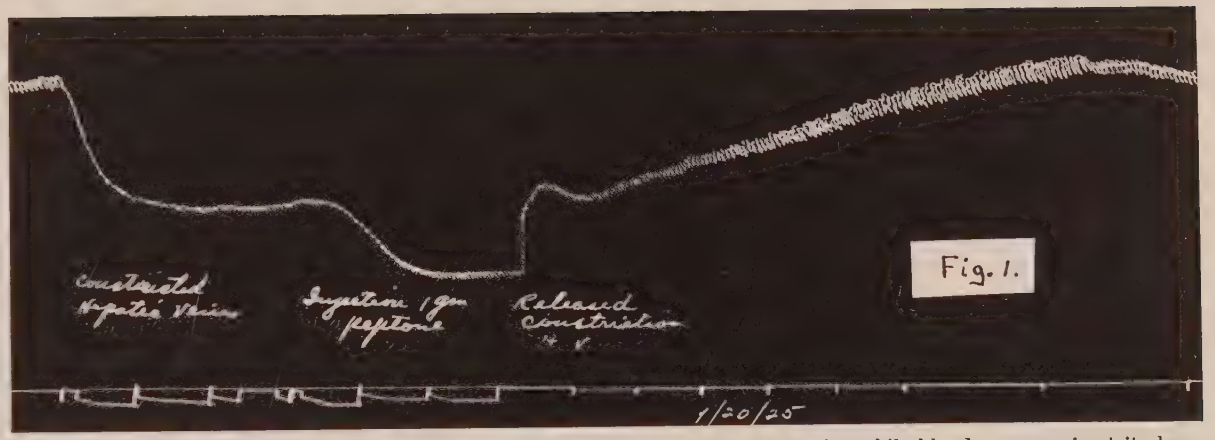

FIG. 1. Peptone shock with hepatic veins mechanically occluded. Release of veins while blood pressure is at its lowest level.

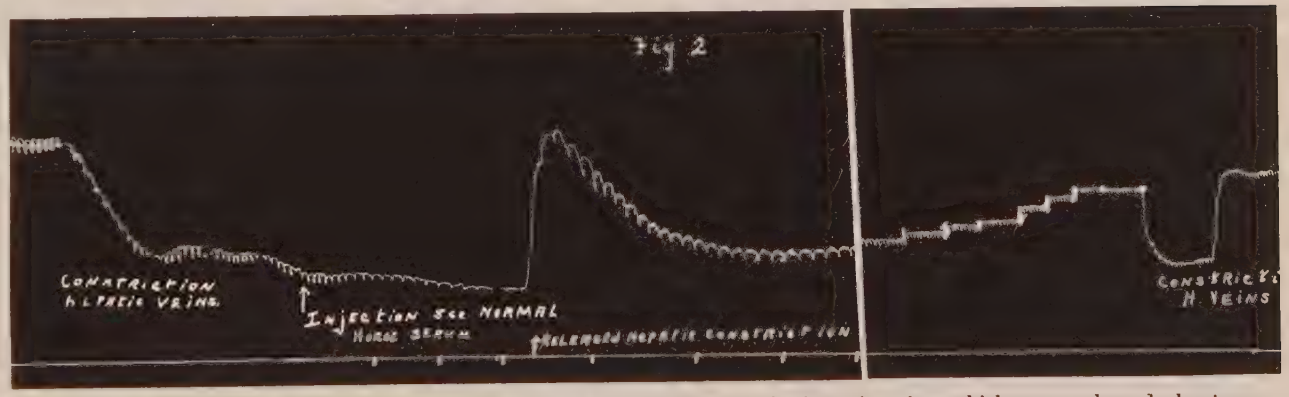

FIG. 2. Non-fatal anaphylactic shock. Serum injected during constriction of the hepatic veins, which were released about one minute later. Slight, slow fall in pressure after injection of serum. Fall in blood pressure due to anaphylactic shock not greater than that caused by obstruction of the hepatic veins.

to be due to the contraction of a strategically placed mass of smooth muscle, it seemed advisable to compare the amount of smooth muscle in the hepatic veins of the dog with the smooth muscle in the corresponding veins in other animals. In collaboration with Dr. Leslie B. Arey we studied the hepatic veins in some twenty different species, including several genera each of carnivorous, herbivorous and omnivorous animals. It was found that the dog was peculiar among the animals studied in that from 60 to 75 per cent of the wall of the hepatic veins consists of smooth muscle.

Having found a histologic basis for anaphylactic shock in the dog similar to that in the guinea pig and rabbit, namely a strategically placed mass of smooth muscle, which when contracted produces a marked effect upon the circulation, it became necessary to determine whether contraction of this smooth muscle of the hepatic veins actually occurs in anaphylactic and peptone shock of the dog. Technical difficulties have thus far rendered our efforts at direct proof unsuccessful. In collaboration with Dr. W. W. Brandes we devised a method by which the hepatic veins can be mechanically constricted, or even completely occluded, without interference with the circulation in other parts of the body. This method consists in passing a small rubber tube through the velamentous ligaments which suspend the liver from the diaphragm, and through the foramen of Winslow, the two being brought out through the abdominal incision. These ends are then passed through two holes bored lengthwise through a small block of wood about 3 inches long, 1 inch wide, and ½ inch thick. A mechanical obstruction is produced by exerting traction simultaneously on both ends of the rubber tube and pressing downward on the block of wood. When the desired degree of constriction of the veins is obtained the tube is clamped at the upper end of the block of wood. This constriction can be maintained for any desired length of time. Other methods have been used to eliminate the hepatic veins from the general circulation, but all of them, among other disadvantages, either involve such extensive insult to the tissues as to induce shock or else they permanently shut the liver out of the general circulation. Our method has four distinct advantages over any previously described attempt to eliminate the hepatic circulation from the general circulation: (1) it causes such slight trauma as to induce little or no shock, (2) it leaves the entire circulation intact, (3) it involves no collateral circulation, and (4) it makes possible the shutting of the liver and splanchnic area out of the general circulation or the returning of them to that circulation at will.

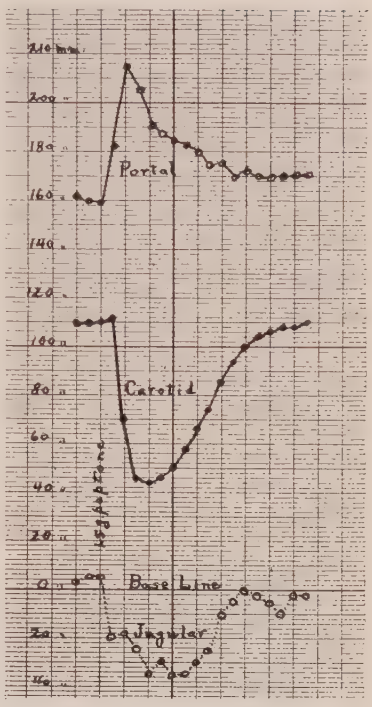

FIG. 3. Portal, carotid and jugular blood pressure tracings in a non-fatal case of peptone shock in a dog. One and five-tenths grams of peptone (Parke, Davis & Co.). Readings of pressure levels made at 15 second intervals.

It was found that complete mechanical obstruction of the hepatic veins caused a precipitate fall in arterial blood pressure which was reduced to from 40 to 60 per cent of the original pressure (Fig. 3). During obstruction the systemic pressure remained at a practically constant level. The animal, therefore, did not "bleed into its abdominal vessels." As soon as the constriction was made the portal vein pressure rose sharply and remained high until the obstruction was released. At the same time the liver became enormously distended with blood. On release of the constriction of the hepatic veins the portal pressure promptly fell and the arterial pressure abruptly rose to a level from 10 to 20 millimeters higher than its level at the beginning of the experiment, and then rapidly fell to approximately its original level.

It is seen from these experiments that some of the phenomena (precipitate fall of arterial pressure, abrupt rise of portal vein pressure and enormous distention of the liver with blood) of anaphylactic and peptone shock can be produced by simple mechanical obstruction of the hepatic veins.

It now remained to be seen whether the injection during the mechanical obstruction of the hepatic veins of peptone or of a foreign protein to which the animal had been previously sensitized, would induce any additional change in blood pressure. For this purpose the hepatic veins were completely obstructed, as already described, and 1 gram of peptone in solution was injected intravenously. This promptly caused further fall in arterial pressure of from 10 to 30 millimeters of mercury (Fig. 4) and indicates that in peptone shock, constriction of the hepatic veins, if it occurs at all, is not the only factor concerned in the fall of arterial blood pressure. This was to be expected for Simonds and Ranson have already shown that peptone itself produces a peripheral dilatation and fall of blood pressure. The additional fall in arterial pressure under the condition of this experiment is therefore due to the peripheral vasodilatation of the peptone.

Another series of dogs was sensitized to horse serum. The hepatic veins were

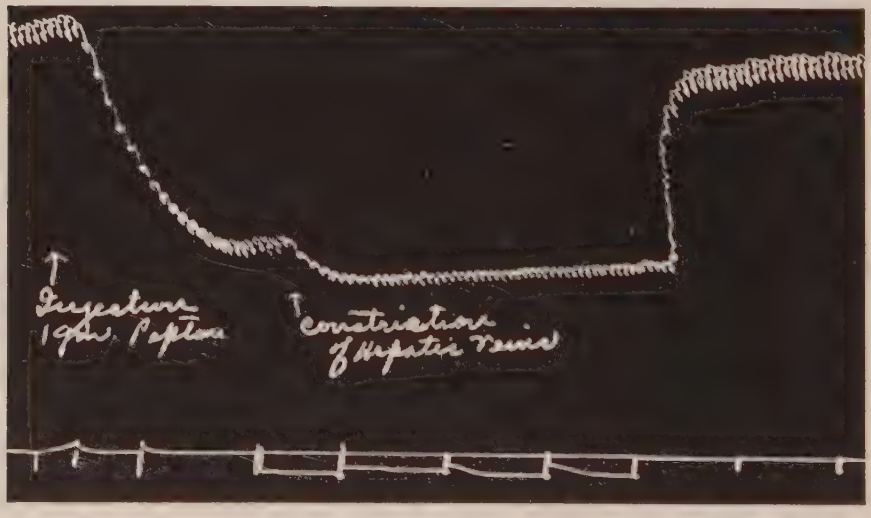

FIG. 4. Constriction of hepatic veins after induction of peptone shock.

then constricted and when the arterial blood pressure had reached a constant level, 5 cubic centimeters of normal horse serum was injected intravenously. There was no change in arterial blood pressure during the following one to five minutes. As soon, however, as the hepatic veins were released the arterial pressure rose abruptly, as in the experiments previously described, and within fifteen seconds began to fall again, and the animal passed at once into anaphylactic shock. A tracing from one of these animals is shown in Figure 5. This experiment shows, first, that it is necessary for a foreign protein to which an animal has been sensitized to pass through the liver before anaphylactic shock is induced; but the fall in blood pressure in anaphylactic shock thus induced is greater than that caused by simple mechanical obstruction of the hepatic veins. It appears, therefore, that some change occurs in the foreign protein during its passage through the liver which results in the formation of some substance which causes peripheral dilatation.

The second fact which these experiments reveals is that fifteen seconds is sufficient time for enough of the circulating foreign protein to pass through the liver to cause the onset of shock. This was further shown in another series of experiments. The hepatic veins were obstructed, foreign protein was injected and the obstruction maintained for from one to five minutes after the injection. The hepatic veins were then released for fifteen seconds only and then reconstricted. In these animals a greater

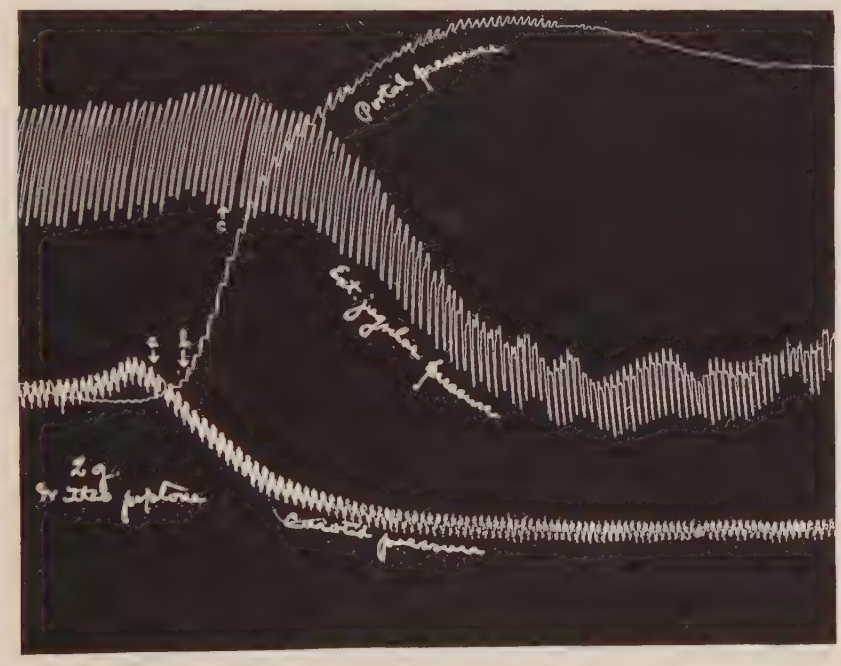

FIG. 5. Direct blood pressure tracings from a fatal case of peptone shock in a dog; a, b and c represent corresponding positions in the several tracings. The rise in portal pressure definitely precedes the fall in arterial pressure. Two grams of Witte's peptone in 10 per cent solution was injected into the femoral vein.

fall in arterial blood pressure resulted than from mechanical obstruction of the hepatic veins alone.

From these experiments a distinct difference between anaphylactic and peptone shock is evident. Peptone itself contains a substance which induces a further fall in arterial pressure, when injection is made during complete obstruction of the hepatic veins. When a foreign protein to which the dog has been sensitized is injected intravenously it must pass through the liver and undergo some sort of chemical change before it can cause any additional fall in arterial blood pressure.

In both anaphylactic and peptone shock there is a marked increase in the outflow of lymph from the thoracic duct. This was formerly believed to be due to an increased permeability of the capillaries, especially of the liver. In six dogs the effect of simple mechanical obstruction of the hepatic veins on the outflow of lymph from the thoracic duct was determined. The minimum increase in outflow in this series was 2.5 times, the maximum 6.2, and the average 5.2 times. If these figures are compared with the increase in outflow of lymph obtained by Petersen, Jaffé, Levinson and Hughes in anaphylactic and peptone shock, it is seen that our averages are almost exactly the same as theirs in anaphylactic shock, namely, 5.45 times, but much less than their average (8.03 times) in peptone shock.

From the experiments thus briefly described the following findings may be summarized:

1. The hepatic veins of the dog can be mechanically obstructed by a very simple procedure that causes, in itself, little or no shock, and that makes possible the turning of the blood in the liver and splanchnic area into or out of the general circulation at will.

2. Complete obstruction of the hepatic veins causes a precipitate fall of from 40 to 60 per cent in arterial blood pressure.

3. The intravenous injection of peptone, while the hepatic veins are mechanically obstructed, causes a further fall in arterial pressure of from 10 to 30 per cent.

4. If a foreign protein to which a dog has been sensitized is injected intravenously while the hepatic veins are mechanically obstructed, no further fall in arterial pressure occurs; but when the obstruction is released this pressure quickly rises to normal, the animal passes at once into anaphylactic shock, and the arterial pressure falls to a level lower than that induced by simple mechanical obstruction of the hepatic veins.

5. In the dog a foreign protein to which the animal is sensitized must pass through the liver before it can induce anaphylactic shock.

6. Mechanical obstruction of the hepatic veins induces an increased flow of lymph from the thoracic approximately equal to that caused by anaphylactic shock, but distinctly less than that due to peptone shock.

THE EFFECT OF DIET ON THE BLOOD CHEMISTRY AND THE LONGEVITY OF THE DOUBLE NEPHRECTOMIZED DOG[1]

By EDOUARD E. LYON, M.S., Chicago
Elizabeth J. Ward Fellow in Physiology

Vicarious elimination was suggested some time ago as the means by which substances usually eliminated by the kidneys are secreted or excreted by the stomach, intestines, salivary glands, sweat glands or lungs. The stomach as well as other portions of the gastro-intestinal tract are the most frequent and efficient agents of vicarious nitrogenous elimination (7). It has also been suggested that vomiting, as seen in cases of anuria and uræmia, may be one of nature's protective mechanisms (8).

This report is the result of an attempt to delay the retention of the nitrogenous waste products by stimulating those processes and organs which carry on vicarious elimination; and to prevent the absorption of toxic products from the intestines, thus prolonging life. Elimination by way of the gastro-intestinal tract was selected as the most likely process by which these results could be produced, and lactose was chosen as the means of stimulation. On a diet low in protein and rich in carbohydrates, the intestinal flora changes from the usual putrefactive flora to a fermentative type, and the intestinal contents have an acid reaction. A low protein diet in itself is influential in delaying the accumulation of the nitrogenous waste products, and it was hoped that the lactose and products of fermentation would stimulate the gastro-intestinal tract and increase elimination by this route.

Previous investigations on double nephrectomized dogs have included a study of the blood chemistry in only a few cases, and in the majority of these cases the results are questionable because of the inaccurate analytical methods employed. However, it is interesting to note the duration of life and symptoms resulting from double nephrectomy in these experiments, and by comparison to ascertain the progress of this present investigation.

Brown-Sequard (3) in 1893 stated that while nephrectomized dogs lived on the average for only thirty hours, similar animals to which kidney extracts were given lived sixty hours.

Herter and Wakeman (5) reported a study of the alterations of the composition of the blood following double nephrectomy. Their investigations revealed that the alkalinity of the blood was increased, the blood urea was increased to ten times the normal value in eighty-two hours or less, and the uric acid content of the blood was not increased. They noted that these dogs developed a loss of appetite, drowsiness, vomiting, diarrhœa, and lowering of temperature. All dogs were bled to death as soon as death seemed imminent. Eighteen dogs lived from twenty-two to eighty-two hours, an average of forty-eight hours.

[1]This work was done in the Physiology Department, Northwestern University Medical School, under the direction of Dr. A. C. Ivy.

Bradford (2) in 1899 in a study of the kidney and metabolism made observations on one nephrectomized animal which was bled to death seventy-two hours after the operation.

Vitzou (11) in 1902 investigated the internal secretion of the kidney and claims to have kept animals alive, following a two-stage double nephrectomy, for as long as from 146 to 164 hours by no other measure than the injection of blood serum from renal veins of healthy animals of the same species.

In the experiments of Ajello and Parascandalo (9), twelve control dogs died in from four to forty-eight hours after double nephrectomy with symptoms of dyspnœa, convulsions, and gastro-intestinal disturbances. Of ten nephrectomized dogs treated with glycerine extracts of kidney substance, one lived ninety-six hours, six lived seventy-two hours, and three lived from forty-eight to fifty-two hours.

Karsner, Bunker and Grabfield (6) found that the average length of life following nephrectomy in three dogs was seventy-six hours; one dog lived for ninety-six hours.

In 1921 Foster (4) noted that in nephrectomized dogs the urea formed 60 per cent or more of the total non-protein nitrogen.

Wallace and Pellini (12) made observations on two dogs each of which lived ninety-six hours.

Allen, Scharf and Lunden (1) in a report of a study of experimental nephritis state that "total nephrectomy produces a condition which is actually fatal, generally within a couple of days."

From these investigations it is seen that the length of life following total nephrectomy is extremely variable, that the shortest length of life is four hours, that the longest is 164 hours, and that the average length is about seveny-two hours; that there has been little work done on the alterations of the composition of the blood resulting from double nephrectomy and much of the work that has been done is open to criticism because of the methods of analysis employed. So far as we have been able to ascertain, no one has investigated the effect of a lactose diet on the blood chemistry and on the longevity of the double nephrectomized dog.

The methods used in our experiments: The dogs used in this work were specially selected, being in the best of physical condition and of an average weight of 18 kilograms. In all cases the initial diet consisted of ground raw meat mixed with bread. In the control animals this diet was continued after the operation for as long as they would eat. In the other animals a diet consisting of 200 grams of bread, 500 cubic centimeters of milk and 100 to 150 grams of lactose was substituted for the meat diet and continued for about two weeks before as well as following operation. When these animals refused to eat they were fed by means of a tube. Specimens of blood were drawn by the use of a syringe and needle from the saphenous vein.

Each of the dogs was given a pre-operative injection of morphine, ½ grain, and atropine 1/100 grain. Anæsthesia was induced with ether. Both kidneys were removed at one operation. Through a midline incision, after the peritoneal fold had been severed at the upper pole of the kidney, the kidney was delivered and decapsulated. The renal vessels were clamped, doubly ligated and cut. The ureter was ligated separately and cut. The incision was then closed in layers without drainage. Time of operation was from fifteen minutes to one-half hour.

TABLE I.—CONTROL DOG ON MEAT DIET

Date	Hours of Life	Wt. in kgm.	N.P.N.	Urea N.	Creat.	NaCl	Remarks
4–30–26		15.2	29.1	21.6	1.1	0.450	
5–1–26		15.2	29.6	22.4	1.4	0.445	Operation at 12 noon.
5–2–26	22	14.8	72.2	38.4	3.4	0.431	
5–3–26	51	14.7	158.8	100.8	8.5	0.429	Vomited
5–4–26	70	14.6	201.6	182.0	10.1	0.387	Anorexia
5–5–26	93	14.3	238.0	235.2	12.5	0.412	Drowsy Vomited
5–6–26	122	12.8	403.2	257.2	14.7	0.341	Diarrhœa Vomited
5–6–26							Died at 2 p. m. in coma.

AUTOPSY: *Head:* Meningeal vessels congested, brain moderately wet. *Chest:* Lungs and pleural cavity appeared to be normal. Pericardial sac contains normal amount of fluid. *Abdomen:* Small stitch abscess at site of incision. Peritoneal cavity contained no fluid. No evidence of hæmorrhage from either kidney pedicle. Stomach showed moderate gastritis. In the lower portion of the ileum there was a moderate congestion of the mucosal vessels. The colon showed no pathology. The liver was very dark and congested. *Extremities:* No pathology noted.

The blood chemistry was performed according to the system of Folin and Wu. A protein-free filtrate was prepared as directed and this was examined for non-protein nitrogen, urea nitrogen, creatinin and chlorides according to the method of Folin. In the early part of the work the urea nitrogen was determined by Folin's method, but later a modification of this method was used in which the contents of the receiving tube were nesslerized following aëration and compared in the colorimeter with a known standard. In several animals the intracutaneous salt solution wheal test was employed to determine whether or not œdema had developed. This test (10) devised by McClure and Aldrich consists of the injection of 0.5 cubic centimeter of 0.85 per cent salt solution intracutaneously. In man the resulting swelling of the cuticle normally disappears in an hour or an hour and a half, but in the presence of œdema it disappears in from five to thirty-five minutes.

Control animals: There were six dogs in this group and their average weight was 17.7 kilograms. These animals were kept on a meat diet before the operation and for as long after the operation as they would eat. After the removal of both kidneys asthenic or latent uræmia developed, and was characterized by progressive weakness, loss of appetite, vomiting, diarrhœa, increasing stupor, coma, and finally death. No œdema developed nor could latent œdema be demonstrated by the use of the intracutaneous salt solution wheal test. None of the animals developed convulsions or muscular twitchings, which are so frequently seen clinically before uræmic death.

In most cases the animals refused food following the operation, but drank water for one or two days. Vomiting usually appeared within forty-eight hours and increased in frequency as death approached. Salivation was noted in one case in seventy hours. Diarrhœa appeared on an average of seventy hours after operation. The average length of life in this group was 105.6 hours; the longest life being 140 hours and the shortest 60 hours. This is much longer than the average life reported

TABLE II.—ANIMAL ON LACTOSE DIET BEFORE AND AFTER OPERATION

Date	Hours of Life	Wt. in kgm.	N.P.N.	Urea N.	Creat.	NaCl	Remarks
7–26–26		19.5	25.2	14.0	1.5	0.41	Has diarrhœa
7–27–26		19.5	32.8	13.0	1.5	0.41	Operation 5 p. m.
7–28–26	14	18.4	56.0	37.2	3.1	0.39	Drank water
7–29–26	48	18.1	87.6	44.8	6.3	0.38	Fed by tube
7–30–26	64	18.1	120.4	104.0	9.0	0.38	
7–31–26	88	17.6	131.6	117.6	9.1	0.37	
8–1–26	112	17.2	163.8	124.5	10.5	0.37	
8–2–26	139	16.2	204.4	131.6	11.7	0.35	
8–3–26	167	15.9	151.2	105.0	13.0	0.35	Vomited
8–4–26	186	15.2	261.3	143.6	15.8	0.34	Vomiting Stupor
8–4–26							Died in coma at 11 a. m.

AUTOPSY: *Head:* Some congestion of meningeal vessels. Brain slightly œdematous. *Chest:* Lungs not œdematous. No fluid in pleural cavity. Pericardial cavity contained normal amount of fluid. *Abdomen:* Slight infection at site of incision. Peritoneal cavity contained no fluid. No hæmorrhage from either renal pedicle. Passive congestion of liver. The mucosa of stomach, lower portion of ileum and colon showed moderate congestion. No evidence of œdema.

by other investigators. The size and conditions of the dogs used in these experiments was undoubtedly a factor in determining the length of life, because, in another group of three dogs in which special selection was not exercised, and whose average weight was 8.6 kilograms, the average length of life following removal of both kidneys was fifty-five hours.

The analysis of the blood of these dogs showed that there was a steady increase in the content of the non-protein nitrogen, urea nitrogen, and creatinin, and a reduction of the chlorides.

Chemical examination of the tissue of the brain and liver, and the bile and gastric contents showed a marked elevation of the urea nitrogen. On autopsy the chief findings were in the gastro-intestinal tract and liver. The stomach presented a moderate gastritis and the lower portions of the ileum and colon were moderately inflamed. The liver was dark and congested. The brain was more wet and congested than normal. The results of the daily blood examination of one of the dogs in this group are given in Table I.

Animals on a lactose diet: There were seven dogs in this group and their average weight was 18.4 kilograms. These animals were on a meat diet for about one week and then the lactose, bread and milk diet was substituted. This diet was usually maintained for two weeks before as well as after operation. When the dogs refused to eat they were fed lactose and milk by stomach tube. When vomiting became frequent they were fed a paste of bread, milk and lactose by use of a stomach tube and grease gun. Before operation all of these animals developed a watery diarrhœa, the fæces showed an acid reaction and contained predominantly gram-positive

TABLE III.—SUMMARY

	Controls (6 Dogs)	Lactose Diet (7 Dogs)
Average life	105.6 hr.	147.5 hr.
Longest life	140.0 hr.	194.0 hr.
Shortest life	60.0 hr.	89.0 hr.
Average weight	17.7 kgm.	18.4 kgm.
Average loss of weight	2.2 kgm.	2.2 kgm.
Appearance of vomiting	48.0 hr.	48.0 hr.
Appearance of diarrhœa	70.0 hr.	Soon after lactose
Appearance of salivation	70.0 hr. (1 case)	
Blood chemistry at death:		
Creatinin	13.8 mgr. per 100 c.cm.	13.3 mgr. per 100 c.cm.
Urea nitrogen	202.9 mgr. per 100 c.cm.	156.6 mgr. per 100 c.cm.
Non-protein nitrogen	308.2 mgr. per 100 c.cm.	322.6 mgr. per 100 c.cm.
Chlorides	0.290 mgr. per 100 c.cm.	0.337 mgr. per 100 c.cm.

	Meat diet* Controls (3 dogs)	Lactose diet* (4 dogs)	Bread and milk diet (3 dogs)*
Average weight	8.6 kgm.	5.8 kgm.	13.4 kgm.
Average life	55.0 hr.	69.0 hr.	55.0 hr.
Longest life	77.0 hr.	77.0 hr.	63.0 hr.
Shortest life	36.0 hr.	60.0 hr.	41.0 hr

*These dogs were selected at random without particular attention being given to their size and physical condition.

organisms. After removal of both kidneys the symptoms of latent uræmia appeared as in the control animals, but developed somewhat slower.

The average length of life in this group was 147.5 hours; the longest life being 194 hours and the shortest 89 hours. In spite of the great variability of the length of life following total nephrectomy, both in these experiments and those of other investigators, a comparison of the average length of life of the control animals with that of the animals on the lactose diet shows that the latter dogs live an average of forty-two hours longer.

The analysis of the blood of these dogs showed that the retention of the nitrogenous waste products does not occur as rapidly as in the control animals.

At autopsy the inflammation of the stomach and intestinal mucosa was found to be more marked than in the control animals, probably because the latter lived longer. The other findings were essentially the same. The results of the daily blood examination of one of the dogs in this group are given in Table II.

There are several probable explanations for the longer average life following removal of both kidneys than have been observed by other investigators. In the first place, the dogs used in my experiments were all in the best physical condition and of an average weight of 18 kilograms. When care is not employed in the selection of animals and small dogs in poor physical condition are used, the duration of life following total nephrectomy is much shorter. In the second place, the operative procedure used in these experiments was simple and rapid, thus postoperative shock was reduced to a minimum.

There are several factors that probably played a part in determining the different picture presented by the animals on a lactose diet from that seen in the control animals: (1) the low protein metabolism instituted before operation and continued after operation; (2) the lack of absorption of toxic substances that stimulate metab-

olism; (3) the lack of absorption of toxic substances that have a detrimental effect on the general metabolic processes of the body, and (4) the delayed accumulation of nitrogenous waste products because of vicarious elimination of these substances by way of the gastro-intestinal tract.

This study confirms the general clinical impression that in certain cases of nephritis patients do better on a low protein or bread and milk diet.

Summary: Removal of both kidneys resulted in the development of a condition simulating that seen in patients with latent or asthenic uræmia. There was a gradual loss of strength with anorexia, vomiting, diarrhœa, and occasionally salivation, increasing stupor, coma and finally death. Œdema and convulsions were not observed.

The average length of life following the removal of both kidneys from dogs on a meat diet was 105.6 hours and from dogs on a bread, milk and lactose diet was 147.5 hours. The latter diet, therefore, prolongs life after double nephrectomy. In the animals kept on this diet it was found that following removal of both kidneys the urea nitrogen and non-protein nitrogen content of the blood did not rise so rapidly.

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LIVER FEEDING IN PERNICIOUS ANÆMIA[1]

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The favorable results reported in the past year following the use of special diets in cases of pernicious anæmia have revived the hope that an effective treatment for this hitherto invariably fatal condition is available. Interest in the subject has therefore been stimulated and considerable light has been thrown on certain factors concerned with the pathogenesis of the disease.

The most valuable recent studies on the effect of diet on blood regeneration have been made by Whipple, Hooper, and Robscheit-Robbins. In carefully controlled experiments on dogs they have shown that both hæmoglobin regeneration and bile pigment excretion are influenced by modifications of diet. Since it is recognized that bile pigment is probably the waste product of hæmoglobin metabolism, and that pigment metabolism is an important process constantly going on in the body, studies of these substances are of particular interest in pernicious anæmia. Whipple and his co-workers found that bile pigment excretion is increased on a carbohydrate and decreased on a protein diet, while hæmoglobin regeneration is slow on a carbohydrate and rapid on a protein, especially on a liver, diet. Speculation as to what may be present in liver or kidneys as a food that will stimulate blood formation is of exceeding interest. These organs are rich in nuclein, and contain a high quality as compared with a relatively low quantity of protein. It has been suggested by Whipple that a deficiency of erythrocyte recticulum material may be present in cases of pernicious anæmia. The hypothesis that pernicious anæmia may be a disease due to a diet deficient in substances required for the buildng of the stroma of the red cells is supported by the presence of very numerous irregular "tag-ends" of red cells apparently well filled with pigment. It has been suggested by Koessler that pernicious anæmia is a vitamin-deficiency disease. The liver has a vitamin content probably higher than that of any other organ. The experimental production of severe anæmia in animals maintained on a deficiency diet and its correction by the administration of vitamins lends support to this theory. The high iron content of liver is probably not a factor in the remissions observed on liver feeding, since there is no iron deficit in pernicious anæmia.

Clinical application of Whipple's diet was made by Gibson and Howard, who in 1923 advocated the use in pernicious anæmia of an iron-rich and vitamin-adequate diet. Minot and Murphy in 1926 reported remissions by the use of a special diet in forty-five cases of pernicious anæmia observed essentially in sequence. The remissions had been maintained in all except three patients who discontinued the diet

[1]From the Clinic of Drs. Charles A. Elliott, Walter H. Nadler, and Paul Starr, Wesley Memorial Hospital.

during the six weeks to two years under observation. These patients were given food rich in complete proteins and iron, particularly liver (120 to 240 grams of cooked calves' or beef liver daily), an abundance of fruits and fresh vegetables, and a relatively low fat intake. All showed a prompt and distinct remission of the anæmia and a general improvement, save only in pronounced disorders due to spinal cord degeneration.

Koessler, Maurer, and Loughlin advocate the following vitamin theory of pernicious and other severe types of anæmia: That the blood and gastro-intestinal changes may be due to chronic vitamin A underfeeding, the nervous symptoms to vitamin B deficiency or absence, and the hæmorrhagic tendencies to partial or complete lack of vitamin C. They recommend a diet containing liver or some other high nucleoprotein food (100 grams daily), fresh fruit and vegetables, a relatively high fat content in the form of butter, cream, milk, and egg-yolk, and the addition of cod-liver oil (5 cubic centimeters four times daily), yeast tablets, and dilute hydrochloric acid (3 drops before, during, and after each meal).

Our experience with liver feeding in pernicious anæmia will be illustrated in detail by the presentation of a patient who has experienced a definite remission. The results in other cases will be summarized in a table. In addition, a patient with severe anæmia, but not of the typical "pernicious type," will be reported because no response to dietary measures was obtained. Our plan of treatment of pernicious anæmia was changed in May, 1926, to include the addition of liver; ¼ to ½ pound, cooked or raw, has been given daily either with meals or by stomach tube. Other measures have been continued as heretofore, without fixed rule, i. e., the administration of dilute hydrochloric acid, cod-liver oil, iron, and arsenic, and quartz lamp exposures.

A case of pernicious anæmia with remission on liver feeding. Mr. S. J., forty-nine years of age, a cattle buyer, whose work was done largely out-of-doors, was under observation in Wesley Memorial Hospital from March 26, 1926, to January 9, 1927. On admission he complained of weakness and of tingling in his hands and feet. These symptoms had been present for two years, and had gradually increased in spite of some periods of improvement. But little weight had been lost. For nine months the patient had had some difficulty in picking up objects; his sense of touch seemed less acute, and he occasionally dropped whatever he was trying to hold. The only gastro-intestinal symptoms were lack of appetite and constipation; sore tongue was not mentioned. Slight dyspnœa, palpitation, vertigo, and swelling of the feet had been noted. There was no renal disturbance. He had had no serious illness. His mother died of carcinoma; an aunt died of tuberculosis.

Physical examination showed a well-nourished white man with slightly lemon-tinted skin. The mucous membranes were very pale, the scleræ were clear. The thyroid gland was palpable; the lungs were clear. The heart appeared to be normal in size; no murmurs were noted; the blood pressure was 120/70. The spleen was not palpable, but had been felt in the fall of 1925. The liver was not enlarged. The genitalia were normal. No abnormal reflexes or gross loss of joint sense were noted. Vibratory sense was maintained over the tibiæ. There was no spasticity. The teeth showed slight peri-apical infection. No pathology was noted in the nose, throat, and ears.

Laboratory examination at the time of admission showed the following: erythrocytes 1,020,000; leucocytes 4,400; hæmoglobin 24 per cent; color index 1 plus. A smear showed marked poikilocytosis. The differential count showed 58 per cent polymorphonuclears; 40 per cent lymphocytes; 2 per cent basophiles. Wassermann reaction was negative. Stools were well-formed; benzidine for blood, negative; microscopic examination was negative. The van den Bergh estimation on August 31 was normal (0.49 milligrams of bilirubin per 100 cubic centimeters of serum). Roentgenographic examinations of the genito-urinary tract and the chest (September 28, 1925) were negative. The fractional meal test (March 20, 1926) showed no free acid; and nine single stomach specimens taken by tube at different times during September and October of 1926 were negative for free acid.

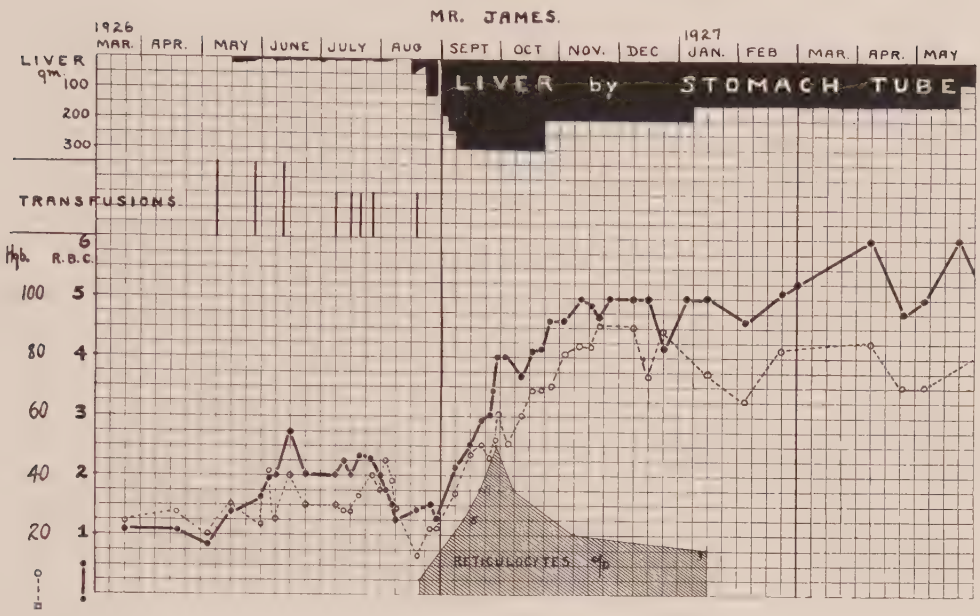

FIG. 1.

Progress and treatment. The nine and one-half months' stay in the hospital may be divided into two periods: the first period includes the five months during which the patient was given the standard treatment for pernicious anæmia, and showed the usual gradual failure; the second period includes the four and one-half months during which he was given liver by stomach tube daily. At the end of the second period he had recovered except for cord degeneration and muscular weakness (Fig. 1).

During the first period he received the following treatment: 50 drops dilute hydrochloric acid, well diluted, with each meal; 4 ounces of cod-liver oil daily; 1 ampoule of iron citrate every second day; ultraviolet light exposure daily; and a fruit, meat, and vegetable diet. In August the patient's mouth and tongue became so sore that he required a mouth spray of 5 per cent cocain before he could eat; powdered opium was occasionally used for diarrhœa. Eight transfusions of citrated blood were given: three of 500 cubic centimeters each and five of 300 cubic centimeters each, from May 10 to August 28.

In August, at the close of this régime, the patient was confined to bed because of extreme inanition. The muscles, especially of the legs, were greatly wasted. The tongue for two months had been growing more and more atrophic, pale, shiny, and painful. The erythrocyte count was reduced to less than 1,000,000 in April, rose to 2,000,000 in May, June, and July, but fell again to 1,250,000 in August, the hæmoglobin ranging from 20 to 30 per cent at the most. During the latter part of May, June, and July an attempt was made to add liver to the patient's diet, but he had always had a marked distaste for liver and refused to do more than chew a bit of it and then spit it out. From August 25 to 30 he was persuaded to try to eat about 150 grams of beef liver a day, but this was too fatiguing, especially because of the soreness of the tongue.

From August 31 to October 21, the patient received an average of 300 grams of puréed, parboiled beef liver by stomach tube daily. Since then, i.e., for five months, he has taken about 150 grams a day by this same method. The previous medication, including the hydrochloric acid, has been continued as before. The clinical transformation began within two weeks and has resulted in a gain of more than 25 pounds. Regeneration of the tongue began early and was complete in ten days. This constituted one of the most striking changes and was complete before any marked effect on the blood was evident. The blood count rose rapidly from 1,200,000 on August 31 to 4,000,000 on September 29 (hæmoglobin 60 per cent), and then gradually to 5,100,000 (hæmoglobin 83 per cent) on November 4, and to date (after six months) is over 5,000,000 (hæmoglobin 85 per cent). The blood smear rapidly approached normal until in

TABLE I.

Case No.	Red blood cell count before liver treatment	Red blood cell count after liver treatment	Red blood cell count 3-10-27	Duration of liver treatment
1	2,250,000	.....	4,700,000	10 mo.
2	2,100,000	4,000,000 in 6 wk.	4,900,000	7 mo.
3	1,500,000	4,000,000 in 7 wk.	4,500,000	4 mo.
4	1,000,000	4,000,000 in 6 wk.	.....	10 wk.
5	3,000,000	4,000,000 in 5 wk.	4,600,000	6 wk.
6	1,000,000	3,000,000 in 4 wk.	3,000,000	4 wk.
7	900,000	2,000,000 in 3 wk.	2,000,000	3 wk.
8	900,000	3,200,000 in 5 wk.	3,200,000	6 wk.
9	1,200,000	2,300,000 in 2 wk.	Died of broncho-pneumonia	3 wk.
10	1,200,000	2,500,000 in 3 wk.	Died of broncho-pneumonia	4 wk.

November only slight traces of irregularity could be found. The reticulate cell percentage was 5 per cent on September 13 and reached 10 per cent on September 25, and since then has continued at 3 or 4 per cent. By October 4 the patient was up in a wheel chair; on October 9 he stood upon his feet for the first time in many months, and by October 15 he could walk across the room. He now walks with the aid of a cane and can climb stairs without assistance. Muscular growth paralleled this recovery of function. His gait is ataxic; coarse joint control is still lacking owing to a combination of weakness and cord degeneration. It is difficult to demonstrate sensory or reflex abnormalities in the legs.

Ten additional cases of pernicious anæmia on liver feedings. In each of these cases there was prompt evidence of blood regeneration. Four of the patients showed a red cell count of 4,000,000 within from five to seven weeks. Five have obtained a complete remission; in one of these cases cord changes have progressed, although the patient's general health is good. Three patients, observed for from three to six weeks, have not yet shown a red cell count of 4,000,000. Two elderly patients with extreme inanition showed prompt improvement, but developed bronchopneumonia and died. It is possible that the necessity of feeding liver to these patients by stomach tube played some part in the development of the purulent bronchitis and bronchopneumonia observed at autopsy (Table 1).

A case of severe anæmia without remission on liver feeding. Mrs. A. H., age thirty-two, the mother of three healthy boys, was admitted to Wesley Memorial Hospital on September 11, 1926. She had felt perfectly well until eight years before (1918), when she had had a severe post-partum hæmorrhage, from which she never fully recovered, in that she retained a degree of anæmia. In 1919, after a streptococcic sore throat, she had a severe uterine hemorrhage for one month; in 1921 she had bleeding from hæmorrhoids for a year. She was fairly well until 1925, when the blood count was 1,600,000. In March, 1926, she had an acute respiratory infection. When two infected teeth were extracted there was considerable bleeding. Three blood transfusions were given after this in order to relieve weakness and tachycardia.

Physical examination: The patient is a fat young woman with definitely icteric scleræ and yellowish skin. No pathology is noted in the nose, throat, teeth or tongue. The lungs are clear. The heart is enlarged, and systolic murmurs are present. The abdomen reveals no pathology. The liver and spleen are not palpable. The uterus is not enlarged, but is slightly prolapsed. Proctoscopic examination reveals no pathology. Reflexes, sensation and vibratory sense appear to be normal. There is no atrophy or spasm of the leg muscles.

Laboratory data: erythrocytes 360,000 (on admission); 520,000 (later); leucocytes 1,900; hæmoglobin 13 per cent; color index 1.85. Smear: poikilocytosis was not marked; there was considerable anisocytosis; the cells were well filled; many large pale red cells were noted; reticulated red cells 8 per cent; platelets appeared frequently in smear. Differential count showed: 90 per cent lymphocytes, 8 per cent polymorphonuclears, 2 per cent eosinophiles.

Fragility (dilution resistance) red cell test was normal (0.46 to 0.38). Bleeding time was two to three minutes. Clotting time was two and one-half minutes. The van den Bergh estimation made three times during April, 1925, was normal. Wassermann reaction was negative. Stomach fractional test: free hydrochloric acid 20, combined 20. Roentgen-ray examination of the genito-urinary tract was negative. Examination of the sinuses showed slight clouding of the left submaxillary sinus. The stools were soft, brown, and contained no blood or parasites. Urinalysis: a trace of albumin; no sugar; some sediment; no red blood cells.

Progress and treatment: Dilute hydrochloric acid, 50 drops three times a day with meals; diet to contain orange juice, tomato juice, vegetables and meat; 200 grams of parboiled liver daily; 100 grams of raw and 100 grams of parboiled liver, recently; 1 ounce of cod-liver oil three times a day; 1 grain of iron arsenite every other day; recently 3 Blaud's pills, three times a day by mouth; ultraviolet light exposure (omitted after a few weeks).

During the first three weeks in September the erythrocyte count rose gradually to 1,400,000 (hæmoglobin 30 per cent). During December it ranged about 2,500,000 (hæmoglobin 42 per cent). Most of the course was afebrile, but in the first two weeks of November a steady fever of unknown origin began, rising to 101° F., with a rapid fall of the red cell count to 390,000. At this point a transfusion was given and was followed by a marked reaction but subsequent cessation of the fever. The red blood count returned to 1,200,000, and later rose. A second transfusion was given in December. There was a slight febrile reaction and marked hæmoglobinuria. Following this eleven slightly infected teeth were pulled without bleeding. The coagulation time was then one and one-half minutes. During January the count gradually declined to 1,900,000. On the assumption that a chronic sepsis existed, a non-protein shock with 10,000,000 typhoid vaccine was given intravenously on January 31. This was followed by a high temperature and by marked hæmoglobinuria for three days and a fall of the red blood cell count from 1,900,000 to 1,300,000, but especially by a fall of the hæmoglobin from 30 to 17 per cent. Since then, during February, the red cell count has continued at from 1,000,000 to 1,600,000; the hæmoglobin from 18 to 27 per cent. Menstruation has occurred several times, but the flow has been scant and of short duration. There have been several slight respiratory infections. The general condition of the patient is remarkably good in view of the severity of the anæmia. Nutrition is excellent, appetite and bowels are normal. As a rule there is no fever. The pulse is about 90. The patient is still confined to bed.

The diagnosis in this case is difficult. The condition is probably one of insufficient blood formation, i.e., aplastic anæmia with occasional purpuric features according to the history of hæmorrhages (although the last platelet estimation was 150,000), associated with constant and occasional great blood destruction as evidenced by icterus and hæmoglobinuria. Blood destruction is evidently not due to fragility of the red cells, since their resistance is normal. That this is apparently not a case of pernicious anæmia (of Addison's type) is indicated by the presence of free acid in the stomach, the lack of tongue atrophy, and the absence of cord changes. Liver administration has been without apparent benefit.

Conclusions: The application of liver feeding to cases of pernicious anæmia suggested by recent experimental work has added to the physician's therapeutic armamentarium for this disease an agent that gives results not approached by any other measure. The clinical fact seems established that liver added in sufficient quantity to the diet of patients with typical pernicious anæmia will produce a remission.

TONUS, HYPERTONUS AND CONTRACTURE

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In the entire field of neurology there is no subject of greater importance than that of tonus, hypertonus and contracture. Normal muscle tonus is the first requisite for the maintenance of the erect posture and for the proper spacial orientation of the body and its several parts. When at rest the biceps muscle, for example, is not entirely relaxed, but exhibits sufficient shortening so that its length exactly equals the distance between its origin and insertion, irrespective of the degree of flexion or extension of the elbow joint. The normal resting muscle always exerts a moderate but steady traction on its point of insertion. Furthermore it exerts this traction with a minimum expenditure of energy and practically no fatigue. Tonus, then, is the steady and indefatigable contraction of the muscles required to hold the different parts of the skeleton in their proper relations in the various and constantly changing attitudes and postures of the body. It may be defined as postural contraction.

Obviously this requires the nicest regulation on the part of the nervous system, and it is not surprising that so delicate a mechanism often becomes disturbed. In tabes, loss of muscle tonus gives rise to loose joints and flail-like movements of the extremities. On the other hand, there is a large group of conditions, including the spastic paralyses, paralysis agitans and the postencephalitic disorders, in which abnormally increased tonus is a chief cause of disability. Hypertonus is so great a cause of disability that when Hunter and Royle announced the discovery of a means of relieving it, they at once had the attention of the entire medical world. Unfortunately their remedy has proved unavailing and their conception of tonus false.

There are three conceptions of the holding mechanism which enables tonic muscle to maintain a shortened length with a minimum expenditure of energy and practically no fatigue. According to one conception, tonus is of sympathetic origin; according to another, it depends upon a proprioceptive reflex from the muscle through the cord and back to the same muscle again; and, according to a third theory, it is due to tonic impulses passing antidromically over the dorsal roots.

The idea that the sympathetic nervous system is responsible for the tonic innervation of skeletal muscle has recently been brought into the foreground by Hunter and Royle. The physiological evidence in its favor has never been convincing and the theory owes whatever prominence it has attained to the histological evidence that skeletal muscle is innervated by unmyelinated as well as myelinated fibers. These unmyelinated fibers were first clearly demonstrated by Boeke.

Last summer (1926) I spent a very delightful day with Professor Boeke in Utrecht and he went to a good deal of trouble to show me his preparations. These are of special interest because they form the chief support for the idea of the sympathetic

innervation of skeletal muscle and the sympathetic origin of muscle tonus. Unmyelinated fibers and their intramuscular endings can be easily seen in his preparations, but his proof that they come from the sympathetic system is altogether inadequate. His best preparations were from the ocular muscles three and one-half days after section of the oculomotor nerve, and hence did not allow sufficient time for the degeneration of the fibers of cerebrospinal origin.

Kulchitsky, a Russian histologist and refugee, working in the anatomical laboratory of the University College, London, confirmed Boeke's observation of the dual innervation of skeletal muscle. Last summer I had the privilege of looking through his preparation of python muscle stained with gold chloride. They are easily the most convincing histological preparations which I have ever seen. Bundles of unmyelinated fibers can be followed for considerable distances and then the individual fibers can be seen to separate and end in grape-like terminals on muscle fibers. Kulchitsky, however, never committed himself as to the origin of these fibers beyond hazarding a guess that they might come from the sympathetic system. His studies on the innervation of frog muscle point in another direction.

Putting aside for the moment the question of the sympathetic origin of tonus there remain for consideration two other theories, both of which are based on the idea that the integrity of the dorsal roots is essential for the maintenance of normal tonus.

The currently accepted idea of the relation of the dorsal roots to muscle tonus is that formulated by Sherrington. According to him, tonus is a nicely regulated, steady contraction designed to maintain posture rather than to produce motion. He thinks this type of steady tonic contraction is a reflex response called forth by afferent impulses arising in the muscles themselves. These impulses travel along the sensory fibers through the dorsal roots to the spinal cord and then by way of the motor roots back to the same muscle again. Section of the sensory fibers in the dorsal roots is said to make the muscles atonic because this reflex arc is broken.

But it is hard to see why cutting the sensory fibers for a muscle should abolish tonus since powerful tonic contraction can be induced from the vestibular labyrinth, from the sensory nerve of the opposite limb and from other sources. It would seem as if afferent impulses from these sources should be able to maintain at least a moderate degree of tonus in the absence of those coming from the muscle itself.

For this reason Frank has suggested that the dorsal roots are important in this connection not so much because they contain sensory fibers from the muscles as because they convey tonic impulses to the muscles. Such special tonic impulses may be thought of as causing a jelling or increase in viscosity of the contracted muscle thus delaying its relaxation.

Frank failed to subject his hypothesis to a thorough experimental test and partly for this reason and partly because it is in conflict with Bell's law, his theory has received but scant consideration.

Tonus and hypertonus and the neural mechanism responsible for them remain unsolved problems of the greatest practical importance. In order that we may not become lost in this obscure and difficult field, we will direct our attention chiefly to a clear cut example of hypertonus, namely that caused by tetanus toxin.

Tetanus toxin causes tonic shortening of the extensor muscles of the legs. These extensor muscles have as one of their chief functions the support of the body against

the force of gravity. The toxin also affects in a similar manner all other antigravity muscles: the muscles on the back of the vertebral column which support the head and tail and the masseter muscle which holds up the lower jaw.

It is these antigravity muscles in which tonus or postural contraction is especially well developed, and it is for this reason that these muscles are involved in the tonic shortening caused by tetanus toxin.

In highly resistant animals like the cat the symptoms are limited to the part of the body that receives the injection. This limited form is known as local tetanus. In the more susceptible guinea pig the symptoms though at first localized quickly become general, because the toxin is carried by the blood stream, to all parts of the body. In the cat the blood seems to be able to destroy the toxin and enormous doses can be injected without causing general tetanus. Local tetanus was fairly common in the world war, developing in patients whose resistance had been increased by a somewhat less than adequate dose of antitoxin.

This cat which I now present received ½ cubic centimeter of tetanus toxin into the muscles along the right side of the vertebral column six days ago. Local tetanus has developed in the right hind leg with an overaction of the extensor muscles and marked resistance to passive flexion. The left leg has also become involved to some extent. The condition of the extensor muscles serves as a very good illustration of what is meant by hypertonus, except that in the right leg the condition has probably already passed beyond the stage of hypertonus into the stage of contracture. We can determine whether the condition is now one of hypertonus or contracture by seeing if the stiffness will relax under anæsthesia.

The cat is under light ether anæsthesia but the rigidity still persists. We will press the anæsthesia further and see what happens. The cat is dead. The stiffness has disappeared from the left leg, showing that the muscles of that leg had only reached the stage of hypertonus, but the stiffness persists in the right leg and is quite sufficient to bear the weight of the body. The muscles of this leg are in a state of contracture.

It is evident that a muscle in tetanus contracture is able to maintain its shortened length after all nerve impulses have been cut off by the death of the animal. The same is true if the nerve impulses are cut off by the section of the motor nerve, although in this latter case the circulation in the muscle remains undisturbed. I have seen contracture persist for days in the quadriceps after section of the femoral nerve.

We may define contracture—in the sense in which we use the term—as a state of permanent shortening in a muscle which persists after section of the motor nerve or after the death of the animal. Since under these conditions no nerve impulses can reach the muscle, it is obvious that when once developed this type of permanent shortening is independent of the nervous system and is due to some change in the muscle itself. In contracture of long standing the muscles are said to have become overgrown with connective tissue. We are, however, not concerned with such chronic fibrotic changes, but with quickly developing contractures in which there is no increase in connective tissue and in which the shortening is due to some changes in the muscle fibers.

There are two ways in which this type of permanent shortening can be produced: (1) by poisoning with tetanus toxin, and (2) by section of a tendon, allowing the

muscle to retract. We have become interested in these types of contracture because of the possible relation which they bear to muscle tonus, representing, as we believe they may, a fixed and irreversible condition of hypertonus.

Within fifteen days after section of the tendo achillis the rat gastrocnemius goes into a contracture very similar to that caused by tetanus toxin. Figure 1 illustrates the amount of shortening which occurs as a result of the tenotomy. The right gastrocnemius is short and plump as if it were in active contraction.

FIG. 1. Photograph of the gastrocnemii muscles of a white rat. The right muscle is in tetanus contracture.

In Table I there are given the data relative to the length and weight of the rat's gastrocnemius and the length of a selected, easily identifiable group of fibers in that muscle. In the first series the right gastrocnemius was in contracture due to tendon section. In the second series the right gastrocnemius was in contracture due to tetanus. The left side served as control in both series; but, because the action of the tetanus toxin is not strictly confined to the side of the injection, the figures for the control leg in the tendon series are to be regarded as representing the normal; and there was some shortening of the fibers in the control gastrocnemius of the tetanus series.

It will be seen from Table I that after tendon section or the administration of tetanus toxin the length of the muscle in contracture is somewhat less than that of the control, but the difference in the length of the fibers is more striking, amounting to 45 or 50 per cent of the length of the same fibers in normal muscle. The muscle in the control leg in the tenotomy series is taken as the normal standard, since the tetanus toxin circulating in the blood stream caused a slight shortening of the

	Right Gastrocnemius, Contracture			Left Gastrocnemius, Control		
Rat.	Length in mm.	Weight in gm.	Fiber length in mm.	Length in mm.	Weight in gm.	Fiber length in mm.
Tend. 1	27.5	1.480	6.5	....	1.870	11.8
Tend. 3	24.1	0.820	6.1	27.5	1.175	9.5
Tend. 4	25.5	0.831	4.1	29.2	0.935	10.1
Tend. 5	26.9	1.180	3.5	31.8	1.535	9.0
Tend. 6	26.0	1.535	4.9	30.2	1.730	....
Tend. 7	22.0	0.820	4.9	25.9	0.943	9.1
Average	25.3	1.111	5.0	28.9	1.364	9.9
T-2	24.7	1.075	4.5	30.1	1.364	8.1
T-3	28.2	1.494	4.8	31.0	1.494	9.0
T-4	24.2	1.479	4.2	26.8	1.405	7.8
T-5	25.0	1.210	6.8	28.5	1.242	10.1
T-6	24.7	1.304	6.0	28.6	1.390	10.0
T-7	28.7	1.470	6.6	29.5	1.569	7.8
Average	25.9	1.338	5.48	29.08	1.410	8.8

TABLE 1.—Showing the effect of tenotomy and of tetanus contracture on the weight and length of the rat's gastrocnemius and on the length of the muscle fibers. Tend. designates the rats in which tenotomy was performed and T. those with tetanus. The left leg served as control.

fibers in the control leg of the tetanus series. The obliquity of the fibers in the gastrocnemius accounts for the much greater percentage of shortening in the fibers than in the muscle as a whole.

The muscles in tetanus contracture have a normal weight. In the six experiments the average weight of the gastrocnemius on the side of the injection amounted to 1.338 grams as against 1.410 grams on the control side and 1.364 on the normal side of the tenotomy series. These differences are much less than the differences in the individual muscles of a series and are therefore of no significance. Hence, in tetanus contracture the weight of the muscle is not affected either by atrophy or swelling; on the contrary, the weight remains normal.

After tendon section, however, an appreciable amount of atrophy occurs. As a result of tenotomy the weight of the right gastrocnemius was reduced to an average value of 1.111 grams as compared with the average of 1.364 grams for the corresponding muscles of the opposite side in the same animals.

Lipschuetz and Audova studied the atrophy resulting from tenotomy in rabbits, found that it was nearly as great as that caused by nerve section, and considered that the atrophy was due to inactivity. After tenotomy as after nerve section they found the relative amount of water in the atrophied muscle distinctly greater than normal.

It is, however, questionable if inactivity forms an adequate explanation of the atrophy following tenotomy. Meyer has shown that if a flexed joint is put up in a plaster cast the flexor muscles atrophy but the extensor muscles hypertrophy. Froboese, who studied these hypertrophied muscles for Meyer, found that except for the hypertrophy of the individual muscle fibers they presented a normal appearance under the microscope. These results seem to show that moderate tension causes hypertrophy, and relaxation causes atrophy of muscles in an immobilized limb.

The atrophy of a muscle following its release from tension after tenotomy and the setting of the same muscle in a condition of permanent shortening are phenomena which are closely related. But neither the atrophy nor the setting has as yet been satisfactorily accounted for.

It is somewhat surprising that a muscle which is allowed to retract after section of its tendon should pass into a state of contracture which appears to be practically identical with that caused by tetanus toxin. Both are alike in shape and in the amount of shortening which has occurred. The contracture which results from tendon section is induced by nerve impulses and does not occur if the motor nerve is divided.

There is some evidence that tetanus toxin has a direct action on the muscle fibers. But this peripheral action of tetanus toxin does not represent its chief or most obvious point of attack. The earliest symptoms of tetanus, spasmodic contraction, and tonic shortening of the extensor muscles are due to the action of the toxin on some part of the nervous system. We have attempted to determine this point of attack by cutting in different animals the sympathetic, sensory, and motor nerve supply of the muscles.

The possibility that the toxin acts on the sympathetic nervous system must be taken into consideration because of the recent work of Hunter and Royle who have attempted to show that the sympathetic system is responsible for normal muscle tonus and for the hypertonus seen in spastic paralyses.

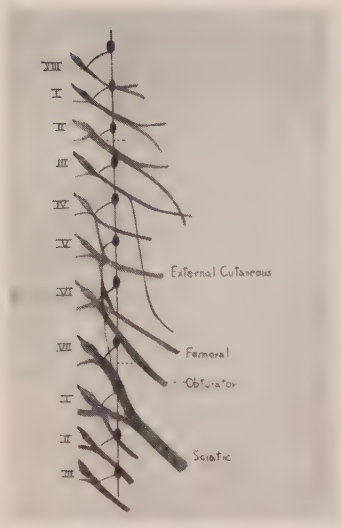

FIG. 2. Diagram of the connections of the lumbar sympathetic chain.

In three cats the left lumbar sympathetic trunk was removed through a median abdominal incision. The success of the operation was later checked by autopsy and it was found that in each cat the left sympathetic trunk had been removed from a point just below the second lumbar ganglion to the brim of the pelvis (Fig. 2). This destroyed all connections through the sympathetic system between the spinal cord and the left hind leg, and caused a degeneration of the postganglionic sympathetic fibers going through the femoral nerve to the quadriceps extensor muscle.

In these three sympathectomized cats equal amounts of tetanus toxin were injected subcutaneously over the femoral trochanters in both hind legs. Local tetanus developed at the same time and to the same extent in the sympathectomized and normal limbs.

Sixty-one days after the removal of the left lumbar sympathetic trunk, the cat (Fig. 3) received 0.08 cubic centimeter of tetanus toxin in both hind legs. This amount proved to be too small to produce a high grade local tetanus, but ten days after the injection, when the photograph was taken, both thighs were moderately abducted. The tonic shortening was confined to the abductors of the hip and was equal in the two legs.

The cat shown in Figure 4 received 0.7 cubic centimeter of tetanus toxin in both hind legs seventy-five days after removal of the left abdominal sympathetic trunk. Three days after the injection the thighs were abducted in the manner illustrated in the preceding slide. On the eighth day, when this photograph was taken, there was marked rigidity of the extensor muscles and the cat could not flex the hind legs to bring them under the body. Both legs occupied exactly the same position of marked extension and both offered equal resistance to passive flexion.

FIG. 3. Cat showing tetanus rigidity in the abductors of the thigh, ten days after the injection of 0.08 cubic centimeter of tetanus toxin over the femoral trochanter in each hind leg. The left abdominal sympathetic chain had been removed sixty-one days before the injection.

FIG. 4. Cat showing tetanus rigidity in the extensor muscles of both hind legs, eight days after the injection of 0.7 cubic centimeter of tetanus toxin over the femoral trochanter in each hind leg. The left abdominal sympathetic chain had been removed seventy-five days before the injection.

FIG. 5. Local tetanus in the de-afferented right leg of cats six days after the injection of 0.5 cubic centimeter of tetanus toxin subcutaneously over the femoral trochanter in each hind leg.

These experiments clearly show that the muscular rigidity of tetanus is not in any way dependent upon sympathetic innervation. Our next problem was to determine the effect of cutting the dorsal roots, because as we have already said these are known to play an important part in the maintenance of muscle tonus. Magnus, who is a supporter of the Sherrington doctrine of the reflex origin of tonus, attempted to solve this problem some eight years ago.

Magnus cut extradurally the dorsal roots containing the sensory fibers for the left triceps. The extradural part of the dorsal root is so short that he must have cut within a millimeter or two of the ganglion or possibly through the proximal part of the ganglion. Ten days after the operation he injected equal quantities of tetanus toxin into both triceps. Tonic shortening of the right triceps developed in the usual manner three days after the injection; but the tetanus toxin had no effect whatever on the de-afferented left triceps. He concluded that the muscular rigidity of tetanus is produced reflexly by afferent impulses coming from the affected muscles and passing through the spinal cord whose reflex excitability has been increased by the toxin.

We have not been able to confirm these results of Magnus.

At periods varying from ten to fifty-three days after section of the dorsal roots of the right lumbosacral plexus we injected small but exactly equal doses of tetanus toxin subcutaneously over the femoral trochanters in each hind leg. About forty-eight hours after the injection local tetanus began in the extensors and abductors of the de-afferented right limb. The stiffness in the right leg continued to increase for several days before the left leg showed any change whatever.

The photographs reproduced in Figure 5 were taken six days after the injection. By this time a little stiffness had developed in the left leg but this is not evident in the picture. On the other hand, the extensors and abductors of the right leg were in continuous tonic contraction, producing a markedly abnormal posture. These photographs however all show the cats during activity and this overaction of the extensor muscles disappeared when the cats were resting quietly. Resistance to passive flexion developed several days later and more quickly in the normal leg.

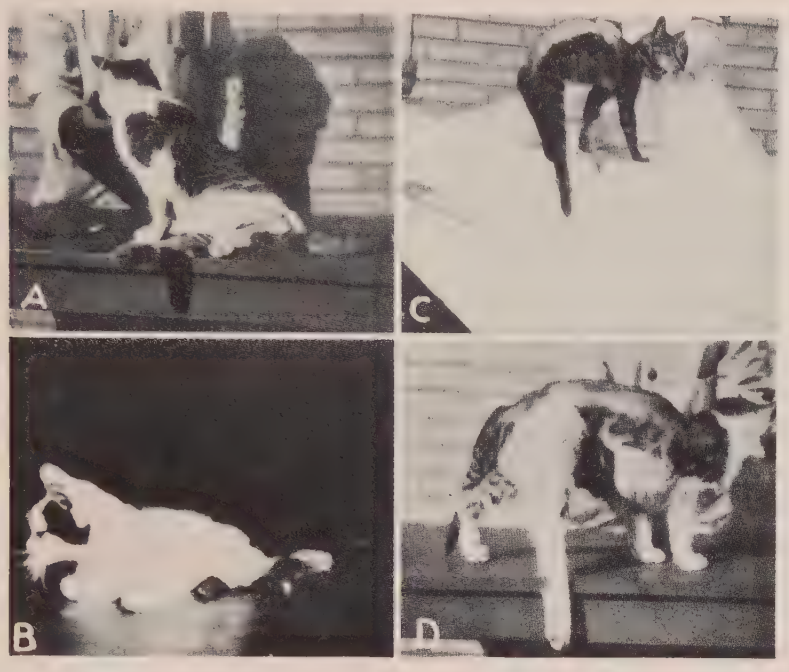

FIG. 6. A. Cat, four days after section of the dorsal roots of the right lumbosacral plexus (third lumbar to third sacral nerve, inclusive); characteristic posture, on the right hip with the right leg extended to the left. B. Cat, six days after section of the dorsal roots of the right lumbosacral plexus (fourth lumbar to third sacral nerve, inclusive); right leg extended to the left. C. Cat, three days after section of the dorsal roots of the right lumbosacral plexus (third lumbar to third sacral nerve); maximal extension of right leg. D. Cat, four days after section of the dorsal roots of the right lumbosacral plexus (third lumbar to third sacral nerve, inclusive); maximal extension of the right leg.

There are then three stages in experimental local tetanus:

1. The stage of overaction of the extensor muscles. Stiffness is present when the animal is actively moving about but disappears during rest. This overaction of the extensor muscles is due to an increased excitability of the reflex mechanism of the spinal cord. It develops more quickly in the de-afferented limb, because the sensory impulses from the muscles, which otherwise would inhibit this overaction, are prevented from reaching the spinal cord by the interruption of the dorsal roots.

2. The stage of increased resistance to passive flexion. This stiffness, which persists when the animal is resting quietly, but disappears under deep anæsthesia, develops more quickly in the normal limb but ultimately develops also in the de-afferented muscles.

3. The stage of contracture, due to a permanent shortening of the extensor muscles, which persists after section of the motor nerves and even after the animal has been killed with an anæsthetic. This contracture develops more quickly in the normal limb but ultimately develops also in de-afferented muscle. We believe that the stiffness of the muscles is of the same nature in the second and third stages. The changes in

the muscle which are responsible for this stiffness are transient and reversible in the second stage but have become permanent and irreversible in the third stage.

We must now turn from the consideration of tetanus to a study of tonus in normal animals. It is generally believed that normal muscle tonus is dependent on the integrity of the dorsal roots; and Foerster has advocated dorsal root section as a cure for the hypertonus of spastic paralyses. Many observers have found that section of these roots in animals causes atonia of the de-afferented limb. But in our experiments this atonia has been only temporary. If the long dorsal roots of the sacral and lower lumbar nerves are cut close to the spinal cord and at a distance of from 1 to 1½ inches from the spinal ganglia the muscles of the corresponding hind limb become atonic for only about twenty-four hours.

After this tonus gradually returns, the extensor muscles usually become markedly tonic and the limb is held in a hyperextended position (Fig. 6).

The tonic overaction of the extensor muscles is well illustrated in the photograph shown in Figure 6 D. The leg assumes the posture characteristic for a very rigid decerebrate preparation. Note the pronounced plantar flexion of the toes, which accounts for the fact that this cat walked with the dorsum of the foot in contact with the ground.

Because of this overaction of the extensor muscles the cat is unable to flex the knee and ankle, and the foot is dragged with the dorsal side down. There is marked spasticity where, since the dorsal roots have been cut, one would expect atonia.

A large part of the overaction of the extensor muscles of the de-afferented leg we are inclined to attribute to the cutting off of the inhibitory afferent impulses, which normally reach the cord from the active muscles along the dorsal root fibers.

The condition of the limb when the animal is resting quietly varies a great deal. In most instances there develops, during the first week after section of the dorsal roots proximal to the spinal ganglia, more or less resistance to passive flexion.

How are we to explain this rigidity of de-afferented muscle which according to generally accepted notions should be atonic? There is the possibility that as a result of the cutting of the small arterioles accompanying the dorsal roots, some damage is done to the spinal cord, but it is surprising that this should express itself in hypertonus of the de-afferented leg while the opposite limb retains its normal tone. The cutting off of afferent inhibitory impulses probably plays an important part in the genesis of this phenomenon. We know that stimulation of any sensory nerve of a leg causes a relaxation of the extensor muscles of that same leg. All of these inhibitory afferent impulses which normally come from the leg are prevented from reaching the spinal cord by the section of the dorsal roots.

It is possible that irritation of the spinal ganglia may be partly responsible for this rigidity. Removal of the spinal ganglia prevents its development.

It is interesting that the spastic condition which sometimes develops in de-afferented muscles is almost identical with that seen in local tetanus.

We believe that the hypertonus produced by tetanus toxin and that which develops in a completely de-afferented limb are closely allied if not identical with that seen in certain clinical conditions and it is our hope that if we can determine the cause and nature of these experimental spasticities we shall be in position to understand some at least of the several forms of hypertonus in man.

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